

Sixteen definitions **ALL** fire investigators **MUST** know:

As outlined in NFPA 1033 and 921

1. Fire Science- NFPA 921 3.3.63 Definition- “The body of knowledge concerning the study of fire and related subjects (such as combustion, flame, products of combustion, heat release, heat transfer, fire and explosion dynamics, thermodynamics, kinetics, fluid mechanics, fire safety) and their interaction with people, structures and the environment.

This is covered in chapter 5 of NFPA 921

2. Fire Chemistry- 5.21.1 defines Fire Chemistry as “The study of chemical processes that occur in fire, including changes of state, decomposition, and combustion.”

3. Thermodynamics- Webster’s defines as “Physics involving the relations of heat with mechanical forms of energy”

4. Thermometry- Webster’s defines as “the measurement of temperature”

5. Fire Dynamics- 3.3.58 defines as “a detailed study of how chemistry, fire science, and the engineering disciplines of fluid mechanics and heat transfer interact to influence fire behavior”

6. Explosion Dynamics – Chapter 21 Explosions discusses all aspects of explosion dynamics with explanations of types of explosions, various categories of damage and various effects.

7. Computer Fire Modeling - Section 20.4 discusses “mathematical modeling” This has various forms and addresses many aspects such as: heat transfer analysis, flammable gas concentrations, hydraulic analysis, thermodynamic chemical equilibrium analysis, structural analysis, egress analysis, fire dynamics analysis, specialized fire dynamic routines, zone models and field computational fluid dynamic models.

8. Fire Investigation- Section 3.3.59 Definition- “the process of determining the origin, cause and development of a fire or explosion” All of 921 is dedicated to this topic.

9. Fire Analysis- Section 3.3.59 Definition- “The process of determining the origin, cause, development, responsibility, and when required, a failure analysis of the fire or explosion” Most of 921 is dedicated to this topic

10. Fire Investigation Methodology- Chapter 4 Basic Methodology discusses the Scientific Method and Systematic Approach. The Scientific Method is the methodology that courts around the country are referencing as they evaluate testimony in Daubert and similar motions to exclude or limit.

11. Fire Investigation Technology- All of 921 discusses the technology of fire investigation; Section 17.4.32 (Measuring depth of char) and 20.4 (Computer modeling) are just examples of specific technology discussed

12. Hazardous material- Chapter 12 Safety discusses various aspects of hazardous material. NFPA 471 and 472 are specific documents that also address this topic.

13. Failure Analysis and Analytical Tools- Chapter 20 is dedicated to this specific topic. This chapter addresses such topics as timelines, systems analysis, mathematical modeling and fire tests.

14. Fire Protection Systems- Both active fire protection (sprinklers, alarms, chemical suppression systems, etc) and passive fire protection (building construction, egress, etc). A new chapter will be included in the next edition of NFPA 921 on this topic. Fire protection engineers are a good resource to look into these issues.

15. Evidence documentation, Collection, & Preservation – There are ASTM standards on this as well as chapter 16 of NFPA 921. This chapter includes the proper procedures to document, collect, store, and preserve evidence.

16. Electricity and Electrical Systems- NFPA 921 chapter 8 is dedicated to this. This chapter addresses numerous topics of electrical systems and

components. Electrical engineers are a good resource to look into these issues.

QUESTIONS TO PREPARE YOURSELF AND THE SUBRO ATTORNEY FOR TRIAL OR DEPOSITION

1. Would you state your full name and address for the record, please?
2. What is your date of birth?
3. What is your social security number?
4. What is your driver's license number?
5. I want to know not only those things that are in your own personal knowledge, but also any information that may have come to you from other sources. Do you understand?
6. Have you been asked or directed to not volunteer information today?
7. Are you currently under the influence of any liquids, medications or other substances or suffering from any mental or emotional distress that would impair your ability to understand my questions or give accurate answers?
8. Have you been treated for any mental or emotional disorders?
9. Has counsel for the principal who engaged you had the opportunity to look through it to see if there is anything as to which your client would claim privilege?
10. How are you presently employed?
11. Are you licensed to investigate fires in **State**?
12. Are you a licensed engineer in **State**?

13. What is your sales tax number?
14. Do you profess expertise in any field of science, mathematics, engineering, or medicine?
15. Has you or your company ever been sued?
16. Have you been convicted of any crimes?
17. Are you suggesting that your method of fire investigation is a science like mathematics, engineering, or medicine?
18. Did you write a report?
19. Why did you write a report?
20. Who typed the report?
21. Did you use a form or template when writing your report?
22. Did you write the entire report yourself?
23. Did you reference any publications?
24. Did you seek assistance in the writing of your report?
25. Are you familiar with the term scientific method?

26. Would you agree that in the absence of testing conducted pursuant to the scientific method that a theory or hypothesis is just speculation and conjecture by another name?
27. How many times have you worked for your client before today?
28. How many times have you worked with your current clients and their lawyers?
29. How much do you charge per hour for today?
30. Using only your memory, please tell the jury the names of the injured parties?
31. What is your understanding of the nature of their injuries?
32. Have you previously testified as to how long a fire has burned?
33. How many times have you testified as an expert at a civil trial or by deposition within the preceding four years in federal court?
34. Please provide your 26.2(b) Federal Rules of Civil Procedures. Production of Previous Testimony.
35. List all documents examined during your analysis of the fire.
36. List all interviews.
37. Was the work performed sufficient when you came to your opinions in this fire loss?
38. What additional responsibilities or participation do you feel should be undertaken in this fire loss?

39. If none are to be performed, do you feel secure in your opinion that the work done is sufficient?
40. Have you suggested any additional work to your client?
41. Have you suggested any additional work to your client that has been "put on the back burner" or delayed?
42. What date did you come to your opinions in this matter?
43. How do you feel about the strength of your opinions as to the origin and cause of this fire?
44. What is your opinion as to the origin of this fire?
45. What is your opinion as to the cause of this fire?
46. With respect to your opinions as to fire origin please detail the reasoning process from beginning to conclusion?
47. With respect to your opinions as to fire cause please detail the reasoning process from beginning to conclusion?
48. What fire literature does the relevant scientific community commonly utilize?
49. What associations does the relevant scientific community recognize?
50. What is the physical size of your professional library?
51. How much is spent annually to maintain your professional library each year?

52. Are your conclusions as to fire cause consistent with NFPA standards?
53. Your methodology is based on NFPA #921 – correct?
54. You are familiar with the National Fire Protection Association?
55. Are you a member of that association"?
56. Do you recognize publications from the NFPA as authoritative?
57. Do you recognize the publication, NFPA 921 - The Guide to the Investigation of Fire and Explosions, to be an authoritative publication?
58. Do you recognize the NFPA 921 as an authoritative guide to the investigation of fires?
59. The NFPA 921 has been developed by a consensus group of renowned experts on fire investigation, correct?
60. To whom is the NFPA 921 directed?
61. Is the NFPA 921 directed to private and public sector fire investigators?
62. Is the NFPA 921 a comprehensive treatment of fire investigation?
63. The NFPA 921 is intended to be founded firmly on scientific methodology, correct?
64. Please identify any area of disagreement with NFPA 921 and state the basis for the disagreement?

65. Have you performed any independent tests that you've conducted in order to satisfy yourself with those portions of 921 that you disagree?
66. Have you ever published any article or books?
67. Have you notified the NFPA of any corrections you feel should be made to their publications?
68. NFPA 921 contains a rather extensive definition of the scientific methodology, does it not?
69. What is the ignition sequence for this fire?
70. What is the ignition source?
71. What is form of material first ignited?
72. What is the type of material first ignited?
73. What is the form of heat?
74. Is your scientific method founded on your experience, training and education?
75. Are you sometimes wrong with regards to your opinions about fires?
76. Have you ever had a jury decide that you were wrong?

77. Have you ever decided a fire was arson only to have a jury decide the fire was not arson?

78. Was not your opinion tested by trial?

79. Have you ever had a jury verdict that was inconsistent with your opinion of arson as a fire cause?

80. Is it your testimony to this jury that you are infallible?

81. Do you make mistakes?

82. Have you every testified a fire was incendiary that was in fact accidental?

83. Courts and juries have disagreed with you in the past, have they not?

84. Have you ever accepted investigations of "limited scope"?

85. Are many cases did you accept last year?

86. How many cases did you refuse?

87. List the number of cases you accepted last year?

88. How many these cases did you tell the client that your findings were adverse to their position?

89. Which edition of the NFPA 921 applied to this fire investigation?
90. Did you develop a hypothesis during your investigation of this fire?
91. Did you utilize deductive reasoning before finding the cause of the fire?
92. Did you utilize inductive reasoning before finding the cause of the fire?
93. Define deductive reasoning and inductive reasoning.
94. List all scientific methods used during your investigation to come to your opinion as to fire cause?
95. List all scientific methods used during your investigation to come to your opinion as to fire origin.
96. List all evidence or items that you removed or caused to be removed from the fire scene.
97. Did you properly document any evidence or items removed from the fire scene?
98. What is the basis for your opinion that you "properly" documented the evidence?
99. During your investigation, did you use publications from ASTM? (American Society of Testing Materials)
100. During your investigation, did you use publications from the NFPA? (National Fire Protection Association)
101. During your investigation, did you use publications from ANSI? (American National Standards Institute)

102. Detail your method of securing artifacts or samples for fire debris analysis?
103. During your evaluation of the subject fire did you consider the effects of heat release rate?
104. Did you observe flame damage?
105. What type of flame caused the most flame damage from direct impingement?
106. What type of flames do fire investigators consider when investigating fires?
107. Did you consider laminar flame damage in your investigation?
108. Are there different types of laminar flames?
109. Did you consider turbulent flame damage?
110. Are there different types of turbulent flames?
111. Do you meet the requirements of The Standard for Professional Competence of Responders to Hazardous Materials Incidents?
112. Were you taught to perform a complete investigation?
113. Were you taught to perform a complete investigation?
114. Where were you taught to investigate fires?

115. Did you complete your investigation?
116. Is your case file open or closed?
117. Is your case file active today?
118. List all heat sources considered during your investigation of this fire.
119. Did you utilize information from NFPA 901 during your investigation?
120. What lab do you use to examine physical evidence?
121. What is your level of confidence in that lab?
122. Are you trained to comply with standards of the National Fire Protection Association?
123. Are you trained to comply with The American Society of Testing and Materials?
124. Did you follow ASTM #E-678 The Standard Practice for the Evaluation of Technical Data?
125. Did your investigation comply with ASTM #E-860? (The Standard Practice for Examining and Testing Items that Are or May Become Involved in Product Liability Litigation)
126. Did your investigation comply with ASTM E-1459? (The Standard Guide for Physical Evidence Labeling and Relation Documentation)

127. Does your report comply with ASTM E-620? (The Standard Practice for Reporting Opinions)
128. Do you qualify as an investigator as per NFPA 1033? (The Standard for Professional Qualifications of Fire Investigators)
129. Agree or disagree – Generally, the longer a fire burns the greater the damage.
130. Did this fire burn a short time or a long time?
131. Agree or disagree – Generally, the longer a fire burns the more difficult the find the origin and cause of the fire.
132. Do you rely on your experience during the investigation of this fire?
133. Do you rely on your training?
134. Did you rely on education?
135. Did you rely on your college degree?
136. Before coming to your conclusion did have to consult a publication?
137. Did you have to consult some literature at the fire scene?
138. Did you utilize the scientific method in your investigation?
139. Did you perform a complete and thorough investigation?

140. Did you follow all of the steps in the scientific process?
141. What was the first step in the scientific method that you utilized in your investigation?
142. What was the second step?
143. What was the third step?
144. What was the fourth step?
145. What was the fifth step?
146. What was the sixth step?
147. List the other steps in the scientific methods utilized by yourself in your investigation.
148. Do you have a college degree in fire science?
149. Do you have even one course in your degree plan titled "Fire Investigation?"
150. Are you familiar with working large fires?
151. Is your investigation methodology based on a science like medicine or nuclear science?
152. Did you perform any tests before writing your report?

153. Was your methodology based on testing in this fire investigation?
154. Did you call for an addition cause and origin investigators or peer review during this investigation?
155. Did you have your methodology evaluated by peer review?
156. Did you cite any reference to the literature?
157. Would you be surprised if one of the other investigators found a slightly larger fire origin than you?
158. That doesn't mean that the other investigator is incompetent or untruthful, does it?
159. Your methodology as to fire origin and cause was based on subjective interpretation of burn patterns, analysis of witness interviews, and scene examination, correct?
160. Is there additional work that needs to be done before you can give the court a conclusive opinion as to the CAUSE of this fire?
161. If your conclusion as to fire cause is inconsistent with NFPA #921 then your conclusion is not based on the scientific methodology, correct?
162. Have you listed all of your opinions?
163. List the physical evidence that supports your origin opinion.
164. List the physical evidence that supports you cause opinion.

165. List any fact that supports your origin opinion.
166. List any fact that supports your cause opinion.
167. Do you agree that we have all of the relevant facts for each of your opinions?
168. What assumptions did you make to formulate your origin opinion?
169. What assumptions did you make to formulate your fire cause opinion?
170. What is the basis of each assumption?
171. What areas or disciplines have you held yourself out to the public as an expert?
172. Did you eliminate natural fire causes during your investigation?
173. Did you eliminate incendiary as a fire cause in your investigation?
174. List all methods you have been taught to eliminate arson as a fire cause.
175. Define natural fire cause.
176. Define incendiary.
177. List natural fire causes you considered and eliminated.
178. Can an incendiary fire be an "accidental" fire?

179. List all accidental fire causes that you considered and eliminated.
180. When did you come to your conclusion as to the origin of the fire?
181. List all physical evidence you have to support you opinion as to the origin of this fire.
182. Detail your exact engagement in this matter?
183. Have you performed work outside of your engagement?
184. Did you formulate any opinions outside of your engagement?
185. List all hypothesis considered.
186. What physical evidence do you have of the first material ignited?
187. Is your methodology based on fire investigation as an art and a science as per NFPA #921?
188. Portions of your methodology require your skills in science and the art of fire investigation – correct?
189. Did you agree that the interpretation of burn patterns is an art not always understood by fire investigators?
190. Did you cause all of the electrical conductors to be examined?
191. Who performed this task?

192. When you form opinions or hypotheses about fires do you set minimum standards for the proof of those opinions?
193. Use of the scientific method dictates that any hypothesis formed from an analysis of the data collected in an investigation must stand the challenge of reasonable examination, correct.
194. Is your opinion as to the cause of this fire based on a reasonable degree of scientific or engineering certainty?
195. Have all reasonable alternatives to your hypothesis as to the cause of this fire been considered and eliminated?
196. Was your investigation based on Sound Engineering Practices?
197. What college courses have you successfully completed on Fire Origin and Cause?
198. List all technical education completed where you were taught how to analyze a fire as to cause.
199. List all technical education completed where you were taught how to analyze a fire as to origin?
200. Was the wiring in the fire loss made of copper?
201. What is the melting temperature of copper?
202. What was the temperature of the fire in the attic of this dwelling?
203. Did you perform measurements of the slab of this dwelling?

204. Did you examine the concrete slab in this dwelling?
205. Did you observe any spalling on the concrete floor?
206. How do you spell "spalling"?
207. Was there any spalling on this concrete floor?
208. Have you ever testified using spalling to support a finding of arson?
209. Have you ever been a firefighter?
210. Have you ever fought a real fire?
211. How many buildings have you observe burn?
212. Are you an engineer?
213. Are you a licensed fire investigator?
214. List all licenses you hold.
215. Have you ever been sued?
216. Have you ever been convicted of a crime?
217. When did you begin you work on your degree?

218. Define fire.

219. Did you consider the "Kinetic Molecular Theory" in the formulation of your opinions? [A rule of thumb used in chemistry which states that the speed of any chemical reaction (fire) doubles for roughly every 18F (10C rise in temperature).

220. The Kinetic Molecular Theory is taught to fire investigators in the basic fire investigation courses, correct?

221. Do you sometimes utilize this theory?

222. Can you explain this theory to the court?

223. Did you perform any calculations?

224. Did you cause any calculations to be performed?

225. Details any calculations performed?

226. What calculations do you commonly perform during fire scene evaluations?

227. Did you prepare any drawings?

228. Did you cause any drawings to be prepared?

229. Detail any burn pattern that supports your position on the origin of the fire.

230. Detail any observations by witnesses that supports your position on the origin of the fire.

231. Detail any scientific evidence of physics or chemistry that supports your positions on the origin of the fire.
232. What utility service provided domestic gas service to the loss?
233. What utility service provided electrical power to the loss?
234. List everyone that agrees with you as to the fire origin.
235. List everyone that agrees with you as to the cause of the fire.
236. List any witness relied upon for your opinion as to origin of the fire.
237. List any witness relied upon for your opinion as to the fire cause.
238. How old was the carpet on the floor of the house?
239. Did the carpet have pad underneath?
240. List locations of ignitable liquids indigenous to the building.
241. How many fire investigators examined the fire scene?
242. List their names or jurisdictions.
243. List each individual trained in fire investigation that came to the same opinion as you as to the cause and origin of this fire.
244. Did the firefighters describe any odors?

245. Do you have criticism of the fire suppression activities of the fire department?
246. Are you an expert on Incident Command of fire scenes?
247. Are you an expert on fire fighting techniques?
248. Do you have an opinion of the abilities of the fire department?
249. Did the fire department perform properly?
250. Will cigarettes ignite gasoline vapors?
251. Was there any material that could fall down?
252. Was fall-down significant in the investigation of this fire?
253. Are you a member of the NAFI?

254. Have you successfully completed the requirements for CFEI – Certified Fire and Explosion Investigator?
255. Are you a member of the International Association of Arson Investigators?
256. Have you successfully completely the requirements for CFI – Certified Fire Investigator from the IAAI?
257. Where do any NFPA standards tell you to begin an electrical investigation?
{breaker box}
258. How many fires have you investigated?
259. What percentage of your fire investigations have you determined to be accidental?
260. What percentage of your fire investigations has been arson?
261. How many arson determinations have you made?
262. Are there few or many accidental fire causes?

263. If you list the fire cause as electrical, does your job pretty much end?
264. Have you investigated few or many electrical fires?
265. What percentages of the fires you investigate have you determined to be "electrical"?
266. Is alloying important to fire investigators and electrical engineers that are examining copper conductors at fire scene?
267. Why? {Aluminum melting onto copper causes alloying which reduces the melting point of the copper conductor from 1981F to around 1200F}.
268. Does any NFPA standard caution against allowing electrical engineers to determine the origin and cause of fires?
269. Aren't electrical engineers mainly used to assist fire investigators in the examination of the electrical system?
270. What percentage of the time do you go to the fire scene and also inspect the electrical environment?
271. Have you written a report? Why?
272. Mark on a photograph the point of origin of this fire.
273. Do you agree or disagree that the strength of an expert's opinion is only as strong as the base of data and the completeness of his/her work?
274. Should this court rely on a sub-standard investigation?

275. Why not?
276. I guess you commonly rely on the National Electric Code [N.E.C.]?
277. Why?
278. What is the purpose of the National Electric Code?
279. Agree or disagree - It is a standard that gives guidelines for experts to follow.
280. Would you want to live in a house that was built to LESS than NEC?
281. Why not?
282. Is the NEC a minimum or the maximum guideline or standard? {minimum}
283. Who publishes the National Electric Code? {NFPA - National Fire Codes}
284. How often is it revised?
285. Are there any changes you would make in the N.E.C.
286. Assume our experts and electrical engineers disagree with some parts of the N.E.C. Would it be proper not to adhere to some of the standards or guidelines if they feel they have good reason to do less than the standard recommends?
287. Have you written reports where you have cited sections of the N.E.C. to show negligence on the part of folks who have failed to follow the code?

288. Is it your opinion that my client has violated any code, standard, or guideline?
289. Are power companies required to follow the NEC?
290. What standards are the power companies required to meet?
291. Are power companies allowed to delete portions of the National Safety Code?
292. Who publishes this code?
293. Is one code more important than the other?
294. Assume a jurisdiction uses the National Fire Codes. Are you allowed to pick and choose within the codes which guidelines and standards to follow?
295. Would it be fair to fault you if you installed a non GFI receptacle in my bathroom right next to my sink?
296. Why?
297. If you failed to meet the code, are you that kind of guy who would stand up and accept responsibility?
298. Would you rely upon an opinion that fails to meet the same code? Why not?
299. If your investigation does not meet standards whose fault is it?
300. Are you aware of any standard published by the N.F.P.A. that gives guidelines on the determination of electrical fires?

301. Are you aware of any standard published by the N.F.P.A. that gives guidelines on the investigation of fires?
302. What assignments were you given by your client?
303. What limitations, if any, were placed on your investigation?
304. Do you agree with the report of the local authorities?
305. What have they determined the cause of the fire?
306. What is the experience of the local authorities?
307. List anyone that you relied upon in the formulation of your opinion.
308. Without reviewing any materials, please draw the floor plan of the house?
{Exhibit}
309. Without reviewing any materials, please draw the room of origin on a separate piece of paper? Include the furniture, light switches, and receptacles? {Exhibit}
310. Without reviewing any materials, please draw the location of the occupants in the room - I just want your memory?
311. Did you have a copy of the fire departments report before you came to your conclusion?
312. Did you make any phone calls in reference to this fire before you

313. Did you call the weather bureau?
314. What was the highest temperature generated in the fire?
315. What is the first material ignited?
316. What is the ignition temperature of the first material ignited?
317. Was there a failure mechanism?
318. Was there a design deficiency?
319. Was there any negligence on the part of anyone?
320. Was there a manufacturing deficiency?
321. Where was the first fire observed?
322. Who first saw the fire?
323. Was anything observed glowing?
324. Was a flash observed?
325. Was smoke observed?
326. Was any dimming of the lights observed?

327. Did the picture tube on the television shrink or collapse?
328. Were any other fires observed?
329. Were any explosions heard?
330. Were any crackling or sputtering sounds heard before the fire?
331. Were any crackling or sputtering sounds heard during the fire?
332. Were any unusual sounds heard before the fire?
333. Was static heard on the radio/stereo equipment?
334. Were there reports of unfamiliar odors?
335. Were there any reports from the users, occupants or witnesses in regards to hot surfaces on a product?
336. Were there any reports from the users, occupants or witnesses in regards to hot surfaces on wall receptacles?
337. Were there any reports from the users, occupants or witnesses in regards to getting a shock or tingle from any equipment, e.g., appliances, piping, etc.
338. Was there a storm prior to the fire?
339. Did it rain within 48 hours of the fire?

340. Was there lightning prior to the fire?
341. Was there any local flooding prior to the fire?
342. What was the temperature at the time of the fire?
343. What was the direction of the wind?
344. What was the wind speed?
345. Did the roof leak anywhere?
346. Were any breakers tripped?
347. Did turning on one product ever trip a breaker?
348. Were any switches operating improperly?
349. Were any receptacles operating improperly?
350. When plugs were inserted or removed, were any supply cords or extension cords operating erratically?
351. Describe all repairs to the wiring?
352. Describe all wiring additions?
353. Was any equipment operating in the area of origin?

354. What type of wiring was used in the building?
355. What year was the structure built?
356. Were there any new appliances or appliances that were used for the first time?
357. Was anyone drying any clothes?
358. What was the position of the HVAC at the time of the fire?
359. Was there a smoke detector? Location?
360. Did you call the Power Company to check with them to see if their equipment had malfunctioned at the time of the fire?
361. Describe the following in the room of origin?
362. *Foundation
363. *Floor covering
364. *Wall covering
365. *Insulation in the walls
366. *Insulation in the ceiling
367. AGREE OR DISAGREE {Standard # 907M}

368. *Electricity as an ignition source should be considered equally with all other sources and not as either a first or last choice.
369. *A physical examination of the fire scene is necessary to discover clues and data to support a conclusion?
370. In the last three years have you ever gone to a fire scene to gather information about the cause of a fire?
371. How many fires have you gone to in the last three years to gather information as to the cause of a fire?
372. How many times by yourself?
373. List all people who have taught you how to investigate fires.
374. Name the location and name of the occupant of fires that you have investigated in the last three years?
375. Has a jury ever been told by a judge to disregard your testimony?
376. How many times have you testified at trial?
377. How many times have you testified by deposition?
378. How many fires have you investigated?
379. How many times have you testified in a criminal trial?
380. How many times have you testified for a person accused of arson?

381. How many times have you testified against a person accused of arson?
382. How many times have you testified against insurance companies?
383. How many times have you testified for insurance companies?
384. Have you ever investigated a fire out of state?
385. Which states?
386. Approximately how many fires have you investigated in the state of **State**?
387. Approximately how many fires did you actually go to the fire scene in **State**?
388. Approximately how many fires did you actually take photographs, evidence, sift through fire debris in **State**?
389. Why did you separate from the International Association of Fire Investigators?
390. Does anyone at your company have permission to sign your name to reports?
391. Who typed your report?
392. What tasks are required at the scene to establish the origin and cause of the fire?
393. Would you expect a fire investigator to take notes, searching the scene, provide photographs and video the scene, interview witnesses, examine evidence that was removed, plat the scene, sift the debris, and inspect the electrical system?

394. Is that how you were taught?
395. Can you name three civil fire investigators such as yourself in **State** that you consider competent?
396. Please name three peers qualified to perform peer review on your methodology and technique used in the investigation of fires.
397. Do you allow a client to choose what information to allow you to see?
398. If I hire you and tell you that you have to work with someone who you feel is totally unqualified or just incompetent, what would you do?
399. If you are not allowed to see all of the information from the fire scene could it adversely effect your opinion?
400. Did you request all of the information from fire experts that were at the fire scene?
401. Have you met with consulting expert, lawyers, or other fire experts?
402. Did you talk with these persons?
403. Have you been trained how to preserve, identify, and transmit evidence from fire scenes?
404. Do you have opinions you wish to add or delete at this time?
405. How many fires did you investigate or analyze in 1999?

406. 1998?

407. 1997?

408. What percentage of the fires you analyze have you opined to be arson and what percentage accidental?

409. Would you describe NFPA #921 as the MINIMUM level standard?

410. List any violation of NFPA #921 by other investigators.

411. Do you hold yourself out to this jury as an expert on K-9 Teams utilized by Fire Investigators?

412. Do you hold yourself out as an expert on fire debris chemical analysis?

413. Did you interview any of the firefighters?

414. Have you ever been allowed to perform your fire analysis while city or state fire marshals are performing their investigations?

415. Weren't you taught to interview the following people?

416. Owner?

417. Occupant?

418. Fire Marshal?

419. Fire Chief?
420. Firemen?
421. Reportee?
422. Neighbors?
423. Police officers?
424. Power Company Employees?
425. Do you charge to review material?
426. Have you billed for the time to review this material?
427. Do you consider eye-witnesses to the fire to oftentimes have very important information about fires?
428. Do thorough fire investigators interview eyewitnesses to the fire they are investigating?
429. What is a C.F.E.I.? (Certified Fire and Explosion Investigator) [N.F.I.]
430. Are you C.F.E.I. designated?
431. Do you meet the minimum requirements to become a C.F.E.I.?
432. Please detail the minimum requirement to the court?

433. How many years of experience are required to become a C.F.E.I.?
434. What technical training is required to become a C.F.E.I.?
435. What type of written test is required to become a C.F.E.I.?
436. What is a C.F.I.? (Certified Fire Investigator) [I.A.A.I]
437. Are you a C.F.I.?
438. Do you have any certification as a fire investigator or fire analysis?
439. Have you now or have you ever been certified by the **State** Commission on Fire Protection?
440. Did you rely upon your client's lawyer to give you information about this fire?
441. Could a re-ignite be important to your opinion?
442. A re-ignite could modify the scene significantly, couldn't it?
443. If there was a re-ignite and you didn't know about could it cause your opinions to be off course even slightly?
444. Was there a re-ignite at this fire?
445. What do the following acronyms stand for: C.F.A.S.T.; F.P.E., Hazard I, A.S.E.T.?

446. Did you consider the ceiling jet temperatures when analyzing the fire?
447. Define ceiling jet temperature.
448. What strata are utilized when securing fire debris analysis?
449. How many fire scenes have you investigated as to fire cause and origin where you actually dug with a shovel?
450. What percent of your work involves investigations of fire scene?
451. List each task that you commonly perform at the fire scenes and explain why you perform each task.
452. Have you taken evidence from fire scenes?
453. Explain the proper way to take evidence at fire scenes.
454. Have you ever been arrested in your life?
455. Has an officer of the law ever threatened you with arrest?
456. What portion of your gross income comes from fire cause and origin investigations?
457. Is it better to actually investigate the electrical environment or are photographs good enough for you?
458. Wouldn't you feel stronger about your opinions if you had been to the fire scene

before the water heater was moved?

459. Did you consider "target fuel packages" in your analysis of this fire?
460. Are you trained in vector analysis?
461. Did you perform a vector analysis of this fire?
462. How do fire investigators utilize a "Vector Analysis"?
463. Define target fuel packages.
464. Did you utilize the Pointer System during your analysis?
465. How is the "Pointer System" used to find the origin of the fire?
466. What temperatures were reached at floor level?
467. What temperatures were reached at ceiling level?
468. Did you consider the heat flux?
469. What is "heat flux"? [The measure of the rate of heat transfer to a surface. Heat flux is expressed in kilowatt/m², kilojoules/m²/sec, or BTU/ft²/sec]
470. Define Fire. [Rapid oxidation usually with the evolution of heat and light]
471. Even good photographs are deceiving sometimes, correct?

472. Better to talk with the fire investigators who examined the fire, correct?
473. What percentage of the fire cause and origin work do you actually go to the fire scene?
474. A violation in one code may or may not be a violation in another code?
475. What fire codes are in the jurisdiction of the fire loss?
476. The National Electric Code (N.E.C.) is used pretty much thorough the United States and other countries, isn't it?
477. Came you name me a similar electric code used by cities?
478. Are you an expert on fire codes?
479. Are you an expert on the NFPA National Fire Codes?
480. Are you an expert on all of the codes?
481. Which codes are you not an expert?
482. How many standards are there in the National Fire Codes?
483. List your employees.
484. List all employees that have left your company in the last five years.
485. Have you terminated any employees in the last five years?

486. Have you ever testified in a criminal trial?
487. Have you ever had a client refuse to pay you for work that you have performed?
488. What year was this house built?
489. Does the subject structure have aluminum wiring?
490. Do you have Errors and Omissions Insurance?
491. Does your company have liability insurance?
492. Did you photograph the scene at the time of your inspection?
493. Did you video the fire scene?
494. Do you have access to a video camera?
495. Did you ask to go to the fire scene so that you could examine the fire scene instead of just examining pictures?
496. Is there anyone living in the subject residence today?
497. Has the residence been repaired?
498. What is the condition of the fire scene today?
499. Did you ask if the fire scene still existed?

500. Describe the progression of the fire details smoke, flame, and heat movement?
501. Do you bill for your phone calls?
502. Do you require reimbursement for long distance service?
503. Have the fire marshals refused to talk with your about this fire?
504. The photographs are only about 1/60th of a second of what the firefighters observed for hours, isn't that true?
505. Which direction was the wind blowing on the night of the fire?
506. Why would that be important to a fire investigator?
507. Do you feel that the firemen have no valuable information about this fire?
508. What have you done to prepare for this deposition today?
509. Have you read my request for documents?
510. Produce all negatives or contact sheets of same?
511. Describe the type of computers used in gathering and analyzing information?
512. Who used the computers?
513. What sort of special software was used?

514. What programs does your company utilize?
515. Is each of the programs licensed?
516. Describe what was done with the computers?
517. Was the bedroom door opened, closed, or partially open at the time of the fire?
518. How is that important?
519. Is that something that is a little important or something that is very important?
520. What tasks did you perform to find an answer to this question?
521. Were the forces on the door important to your investigation?
522. Have you calculated the mass flow through the doors?
523. Why not?
524. Explain how fire investigators calculate mass flow through doors?
525. Is that something that would be important for you to know?
526. Please discuss the lateral flame spread in this fire?
527. Would you describe the plume filling rate as slow, fast, or somewhere in the middle?

528. Did you consider ceiling jet temperatures in your investigation?
529. Did you consider ceiling plume temperatures in your investigation?
530. Did you consider atrium smoke temperatures in your investigation?
531. Did you consider the "Q-10" factor in this fire? (fire doubles in size for each 10C or 18F)
532. What is the importance of "Q-10" when calculating fire dynamics?
533. Trace the movement of the fire from the origin to the extinguishment?
534. Can you estimate the ceiling jet temperatures in this fire?
535. Can you estimate the atrium smoke temperatures reached in this fire?
536. Can you estimate the ceiling plume temperatures?
537. Please define the following:
538. Ceiling Jet Temperatures
539. Atrium Smoke Temperatures
540. Ceiling Plume Temperatures
541. Mass Flow through an opening

542. Lateral Flame Spread
543. Plume Filling Rate
544. Were there any smoke detectors in this home?
545. Were they battery or household current?
546. Where were they located?
547. Did they activate?
548. Would a smoke detector placed in the hall have made any difference in this fire?
549. Cite any publications or standards reviewed or relied upon by yourself in the formulation of your opinions?
550. Did you personally do all the work that led to your opinions?
551. List every subject that you have offered yourself as an expert for court.
552. List all of the fire causes you considered and eliminated in coming to your opinion as to the cause of this fire.
553. Did anyone at your company remove anything from your file?
554. Have you removed anything from your file?

555. Have you ever mis-called a fire before?

556. List any fire analysis that you hand to file a correction to your original report.
557. Have your ever been a firefighter? Where?
558. What would happen if I threw a match into a measuring cup of gasoline?
559. Are you positive?
560. What would happen if I put a burning cigarette into a cupful of gasoline? [nothing]
561. List cases where you looked at a client's case and told them THEY were wrong, and you couldn't help them.
562. Does your company have a flat rate fee?
563. Who is the fire chief on this fire?
564. What is the reputation of the Fire Chief?
565. Did you personally talk with the Fire Chief?

566. List the people who you relied on to give information about the fire.
567. Have you ever analyzed a fire and found evidence of arson?
568. List the number of times.
569. Did you notify the fire marshal of the jurisdictions?
570. If, in investigating this fire, you concluded it to be arson you bring this to the attention of the authorities?
571. Have you investigated or analyzed fire for cause and origin for insurance companies?
572. You entered most of these homes under the insurance policy condition of "reasonable inspection?"
573. Explain your office structure.
574. Have you ever been fired from any job in your life?
575. List each job you have held and give your reason for leaving.
576. How would you describe the work you performed at this fire?
577. Are you a member of the International Association of Arson Investigators?
578. Do they send out a publication?

579. Do you rely on this publication?
580. Do you rely upon standards from the NFPA?
581. Do you at times rely on books such as the following?
582. N.F.P.A. Handbook
583. N.F.P.A. Fire Codes?
584. NFPA #70 {National Electrical Code}
585. National Fire Academy {Fire and Arson Investigation}
586. Kirk's Fire Investigation {J.R. DeHann; Kirk's dead}
587. Fire Investigator's Handbook
588. Practical Fire and Arson Investigation O'Connor
589. ATF Arson Investigative Guide {Department of Treasury}
590. Fire Cause Determination {IFSTA}
591. Anatomy of Arson {French}
592. Investigating Arson {Bennett/Hess}

593. Incendiary Fires {Swab}
594. Elements of Arson Investigation [Huron}
595. Arson Investigation {Robert Carter}
596. Investigating the Fireground {Phillipps/McFadden}
597. Burning - A Guide to Fire Investigation {Barracato}
598. Journal of the Arson and Fire Investigator? {IAAI}
599. Selected Articles for Fire and Arson Investigators {IAAI}
600. The Fire Investigator's Handbook {Holmes}
601. Fires and Explosions {Kennedy}
602. Explosion Investigation and Analysis {Kennedy}
603. The Investigation of Fires {Roblee/McKechnie}
604. Elements of Fire and Arson Investigation {Bates}
605. Arson Investigation - The Step-by-Step Procedure {Bouquard}
606. Fire...Is it Arson? {Barracado}

607. Fire Investigation Handbook NBS #134 {Brannigan}
608. Arson - The Complete Investigator's Manual {Paladin Press}
609. Was it Arson? {R. G. Provencher - National Director INS}
610. A Pocket Guide to Arson Investigation {Factory Mutual}
611. Benard Be'land, University of Sherbourne, Canada
612. Bruce Ettlign Articles on Electrical Fires
613. National Fire Academy {Fire and Arson Investigation}
614. Practical Fire and Arson Investigation [O'Connor]
615. Fire Cause Determination {IFSTA}
616. Investigating Arson {Bennett/Hess}
617. Arson Investigation - The Step-by-Step Procedure {Bouquard}
618. Fire...Is it Arson? {Barracado}
619. Arson - The Complete Investigator's Manual {Paladin Press}
620. A Pocket Guide to Arson Investigation {Factory Mutual}

621. Are you licensed to investigate fires in **State**?
622. Does your company have a **State** Sales Tax Certificate?
623. Please supply a copy of your **State** Sales Tax Certificate.
624. Did you charge sales tax?
625. What percentage sales tax do you charge?
626. What text did you rely on in developing your opinion?
627. Do you have a N.F.P.A. Handbook in your library?
628. Which edition?
629. Have you read the N.F.P.A. Handbook?
630. Is it an authoritative text?
631. Have you read "Kirk's Fire Investigation"
632. How is the editor of this book? {J. R. DeHaan}
633. Is it an authoritative text?
634. Have you read "The Fire Investigator's Handbook"?

635. Is it an authoritative text?
636. Who is the author?
637. Have you read "Fire, Arson, and Explosion Investigation"?
638. Who is the author?
639. Is it an authoritative text?
640. Do you or your company have a professional library?
641. Describe your library in detail.
642. Does you or your company have copies of depositions that you have given?
643. Does you or your company have copies of depositions that other experts have given?
644. Does your company have a brochure?
645. Does your company give speeches at seminars or classes on the subject of fires?
646. Does your company have slide programs or video programs that they have developed or caused to be developed?
647. Describe the program and the person who has custody of the program?

648. Have you ever taught a seminar on fire investigation?
649. What is meant by a fire tetrahedron?
650. If you found heavy crazing on the window glass at a fire such as this one, what would that tell you?
651. What government standards did you research during your investigation?
652. Did you study or reference any UL standards or any standard before making your opinion in this matter?
653. Did you determine the point of origin?
654. Draw on a plat the exact point of origin.
655. Are you telling the jury that you know exactly what happened?
656. What is an electrical short?
657. What temperatures will an electrical short cause?
658. What color is the wire insulation on the neutral wire in common household wiring? [White]
659. What color is the wire insulation on the hot wire? [Black, red, colored]
660. What color is the wire insulation on the ground wire? [green]

661. In a common polarized electrical receptacle, which side has the larger prong [left or neutral prong]
662. Does the N.F.P.A. have standards or guidelines for determining the cause of electrical fires?
663. Name these guidelines or standards.
664. Do you have a copy of these standards or guidelines?
665. Do you use these standards or guidelines?
666. Does the N.F.P.A. have standards or guidelines on report writing?
667. Does the N.F.P.A. have standards or guideline on notes to take in the field at fires?
668. Is there a NPPA Standard on "Investigating Fires"? (NFPA #921)
669. Name these standards or guidelines.
670. Do you follow these guidelines?
671. Does your company or you have these guidelines?
672. Do you have some type of field form or guideline that you utilized in your investigations?
673. Have you ever been proven wrong on a fire call?

674. Have you ever been deposed on a fire case that you were unable to visit before the scene was altered or because it no longer existed?
675. Have you ever testified in court on a fire case that you were unable to visit the fire scene because it no longer existed?
676. Have you ever consulted with attorneys or insurance company representatives in regard to a fire where you were unable to visit the fire scene because it no longer existed?
677. Who do you formulate an opinion with before actually going to the fire scene?
678. Did you find the origin of the fire first or the cause first?
679. Are factually and correct reports important to you?
680. If a client told you that they did not want a sample taken, then what would you do?
681. When you take samples do you request permission from the client to send them to a forensic laboratory?
682. As a fire expert have you ever been in the position of attempting to interpret patterns contained in photographs to either attempt to determine the origin and cause of a fire or to determine the validity of another expert's claim.
683. Describe the area of origin determined by the fire marshal's and fire investigators in detail:
684. All electric devices

- 685. All receptacles
- 686. All switches
- 687. All lighting
- 688. All electrical devices?
- 689. Floor Coverings
- 690. Wall coverings
- 691. Window
- 692. Door
- 693. Ceiling material
- 694. Was there any wiring in the attic?
- 695. What conditions cause low burning?
- 696. Who reported the fire to the fire department?
- 697. Did you talk to witnesses personally such as:
- 698. Reportee

699. Eye Witnesses
700. Neighbors
701. Firefighters
702. Other fire experts
703. First Police Officer (on scene)
704. Do these people sometimes have important information?
705. Why didn't you talk to these people?
706. Why would you want to interview the reportee?
707. Why would you want to interview the neighbors?
708. What is a neighborhood canvass?
709. Why would you want to interview the firefighters?
710. Why would you want to interview the first police officer at the scene.
711. Did a police officer come to the fire scene?
712. Was there a police report written in reference to this fire?

713. Did you try to obtain a copy of this report?
714. Why would you want to interview eyewitnesses?
715. Are you aware of any problems that the fire department had when attacking the fire?
716. Why would you want to know the wind direction, wind speed and other weather conditions at the time of the fire?
717. Are things like wind direction and speed important to the way a fire burns?
718. Did you get a weather report?
719. Why not?
720. Who is responsible for doing such tasks?
721. Assume with me that you have not thoroughly and completely investigated a fire, whose fault would it be? Yours or your client?
722. Have you talked to any other employee of the fire department about this case?
723. What additional work have you performed since you completed your report?

724. Have you done any type of reading or study in reference to this fire?
725. Have you recommended any testing?
726. What is a calorimeter?
727. What does it measure?
728. Does your company test for heat release?
729. Does your company own a furniture calorimeter?
730. Are you aware of any testing recommended?
731. To your knowledge are any tests planned?
732. Did you take any notes at the fire scene?
733. Did you use a recorder at the scene?
734. Did you get a copy of the police report? Why not?
735. What other tests have you performed in reference to this case?
736. What tests have you recommended to your client?
737. Are you aware of any tests performed by other individuals in this matter?

738. Are you aware of any tests performed outside of this case that may have relevance in this matter?
739. What information were you given that would disprove your theory in this case?
740. Is there any information, no matter how small, that supports the position of Introspect?
741. Does your company have a brochure?
742. Have you produced your billing file?
743. Did you find the origin of the fire first or did you find the cause first" [I.A.A.I. "12/86 - In the study of a fire the first step always consists of finding its point of origin.
744. Are you an expert on fire safety?
745. Are you an expert on fire inspection?
746. Are you an expert on marketing?
747. Are you an expert on failure analysis?
748. How long did the fire burn before the report of fire?
749. If the device shorted out why didn't the breaker trip?
750. What type of wire was used for the service drop?

751. Was the service underground or aerial?
752. Were hydrocarbons found in the area of origin?
753. Are you an expert on forensic fire debris analysis?
754. What information did NOT support your theories? Is there even a small bit or piece of information inconsistent with your theory?
755. Had this family suffered any fires previous to this one?
756. Would that be important to your investigation?
757. What are the motives for arson as per NFPA? (901)?
758. Is there anything you would like to add so as not to be misunderstood?
759. Do you feel the need to clarify any information given in this deposition?
760. What equipment was energized in the area of origin?
761. Were any of the electrical appliances malfunctioning before the fire?
762. How do you know?
763. Would that be important to know?
764. Why?

765. Did you ask?
766. Where did the firefighters first see fire?
767. Was there a flashover in the attic?
768. Were there any small explosions? How do you know?
769. Was there an explosion as outlined by the fire fighters?
770. What caused the explosion?
771. Were there blue flames?
772. What is the importance of blue flames?
773. What caused the blue flames?
774. Was this a fast fire?
775. Was this an extremely fast fire?
776. Did the firefighters smell any unusual odors at the fire scene?
777. Was there an electrical storm prior to the fire?
778. How many fire debris samples did you take in 1996? 1995?

779. What was the critical radiant flux {measurement of temperature} at ceiling level during the fire?
780. What was the critical radiant flux {measurement of temperature} at floor level during the fire?
781. What type of fire stream did the firefighters use to extinguish the fire?
782. Agree or disagree - Fire burn upwards and outwards?
783. What is the rule of 800 and 2000? {aluminum, copper, iron melting points 1200/2000/2800}
784. Did you use the scientific method during your investigation?
785. {Assignment; Preparing for the Investigation; Examination of the scene; Recording the scene; Evidence; Analyzing the Incident; Reporting Procedure}
786. Does your company have a written format or guideline to investigate fires or failures?
787. Have you attended any seminars on fire causation?
788. Have you attended any seminars on fire origin?
789. Have you attended any seminars on fires?
790. Have you attended the basic training for arson investigators?
791. Have you been trained by a licensed fire investigator?

792. Do you have any type of logbook documenting your training in fire investigation?
793. AGREE OR DISAGREE: {NFPA 921}
794. The term "Fire Scientist" is NOT recognized by NFPA?
795. The opinion or conclusion of the investigator testifying as an expert witness is of no greater value in ascertaining the truth of a matter than that warranted by the soundness of the investigator's underlying reasons and facts. [5-7.2]
796. Those individuals not specifically trained and experienced in the discipline of fire investigation and analysis, even though they may be expert in related fields, may not be well qualified to render opinions regarding fire origin and causes. [6-5.1]
797. What does the term "related fields" mean to you? {Related fields are Materials, M. E., E.E., Chemical Engineer/chemist, Fire Protection Engineer, Industry Expert}
798. In order to offer origin and cause opinions, additional training or experience is generally necessary.
799. Fire investigation is based on the scientific method.
800. Was the point of origin of your theory in the corner, center, or along the wall of the attic?
801. How have you eliminated arson in the attic?
802. Arson in the attic is consistent with owner/occupant caused fire - correct?
803. Strangers don't go into the attic?

804. Define plume. {The column of hot gases, flames, and smoke rising above a fire. Also called convection column, thermal updraft, or thermal column}
805. Trace the thermal updraft of this fire.
806. Define thermal updraft.
807. Trace the thermal column of this fire.
808. Define thermal column.
809. With a fuel package in the corner of a room is the time to flashover shorter or longer than a fire in the center of the room? {Shorter}
810. Do fires usually burn upwards and outwards.
811. According to the NFPA #921, the origin of the fire must be found before establishing the fire cause - correct?
812. Would you advise our jury to rely on an "expert" who was not skilled on burn patterns, would you?
813. IF you can't find the origin, then, you can't find the fire cause - correct?
814. An origin is documented by burn patterns, correct?
815. It is imperative that burn patterns are examined carefully by fire investigators before determining fire cause?
816. NFPA literature defines burn patterns, correct?

817. Did you observe both basic types of burn patterns at this fire scene?
818. What are the two basic types of burn patterns as per the NFPA literature {NFPA 921 - movement and intensity}
819. Was the window in the bedroom open or closed during the incipient stages of the fire?
820. Was this fire ventilation controlled? {Yes}
821. What type of insulation was provided in the attic of this loss, if any?
822. Were vermiculite particles or mineral fibers important to the fire dynamics in the living area of the fire? {Yes - embedded in the gypsum to preserve the strength of the wallboard}
823. Were the springs on the bed annealed from this fire?
824. What information is gained from observations of annealed of the bed springs?
825. Did you observe any "V" burn patterns?
826. Did you observe any hourglass burn patterns?
827. Did you observe any truncated cone burn patterns?
828. Did you observe any hourglass burn patterns?
829. Did you observe any "U" shaped burn patterns?

830. Did you observe any inverted cone burn patterns?
831. Did you observe any "Saddle Burn Patterns"?
832. Did you observe any "Donut Burn Patterns"?
833. What information does a "V" burn patterns provide fire investigators?
834. What information does an "Hourglass" burn pattern" provide fire investigators?
835. What information does a "Truncated Cone" burn pattern provide fire investigators?
836. What information does a "U - Shaped" burn pattern provide fire investigators?
837. What information does a "Inverted Cone" burn pattern provide fire investigators?
838. What information does a "Saddle" burn patterns provide fire investigators?
839. What information does a "Donut" burn patterns provide fire investigators?
840. Would it be more correct to say the origin of this fire if accelerated with an ignitable liquid in the living area would be expected to have a "V" burn pattern or a "U" burn pattern?
841. What is the difference between a "V" pattern and a "U" pattern?
842. What causes wide based "V" patterns?
843. What causes narrow based "V" patterns?

844. What causes hourglass burn patterns?
845. What causes "U" burn patterns?
846. What causes hourglass burn patterns?
847. What causes truncated cone burn patterns?
848. What causes inverted cone burn patterns?
849. Sir, your not really educated in analyzing burn patterns are you?
850. Are you an expert on fire explosions too?
851. Define explosion. {a physical reaction characterized by the presence of high pressure gas, confinement of that high pressure gas, rapid production or release of that pressure, and change or damage to the confining element, structure, container, or vessel caused by the pressure release}
852. Did this fire manifest a backdraft?
853. Did you use vectors during your investigation?
854. Define vectors. {an arrow used in a fire scene drawing to show the direction of heat, smoke, or flame flow}
855. Did this fire have flame roll-over?
856. What is a fire tetrahedron?

857. What is the difference between a fire triangle and a fire tetrahedron?
858. Define pyrolysis. {The transformation of a compound into one or more other substances by heat along. Precedes combustion}.
859. Did you develop an "Isochar" during your analysis of this fire?
860. What is an "Isochar"? {A line on a diagram connecting points of equal char depth}
861. What calculations could be done to validate your opinions?
862. Was this a fast fire or a slow fire?
863. What is the significance of a "pulled" light bulb? {points to the origin of the fire}

864. Agree or disagree: Weather conditions at the time of the fire must be determined in advance of the scene investigation in order to properly conduct the cause and origin determination.
865. Agree or disagree: A series of exterior shots should be taken to establish the location of a fire scene.
866. Agree or disagree: Video should be used in conjunction with still photographs.
867. Did you have access to a video camera during your investigation of the fire scene?
868. Do you recognize the importance of the documentation of the fire scene via a video camera?
869. Agree or disagree: All ventilation points accessed or created by the fire should be photographed, as well as all smoke, heat, and burn patterns.
870. Did you photograph all ventilation points accessed or created by the fire?
871. Please present each photograph that depicts each ventilation point accessed or created by the fire.
872. Did you photograph all smoke patterns?
873. Please present each photograph that depicts smoke patterns utilized in your opinion.
874. Did you photograph all heat patterns?
875. Please present each photograph that depicts heat patterns utilized in your opinion.

876. Did you photograph all burn patterns?

877. Please present each photograph that depicts each burn pattern utilized in your opinion.

878. Agree or disagree: Closets and cabinet interiors should also be documented.

879. Did you carefully photograph the closet and cabinet interiors?

880. Please publish the photographs to the court.

881. Agree or disagree: All furniture should be photographed in its original position before and after reconstruction as well as any protected areas left by any furnishings or other contents.

882. Did you photograph all furniture in its original position before and after reconstruction?
883. Please publish the photographs to the court.
884. Did you photograph all protected areas left by any furnishings or other contents?
885. Please publish these photographs to the court?
886. Agree or disagree: The position of doors and windows during a fire is important, so photographs should be taken that would document those indications and resulting patterns.
887. Did you photograph the position of doors and windows during your investigation?
888. Please publish the photographs to the court.
889. Agree or disagree: Clocks should be photographed to indicate the time power was discontinued to them or the time in which fire or heat physically stopped their movement.
890. Did you photograph the clocks that would document the time power was lost?
891. Please publish the photographs to the court.
892. Agree or disagree: The utility entrances and controls both inside and outside a structure should be photographed.
893. Did you photograph the utility entrances and controls inside the structure?
894. Please publish the photographs to the court.

895. Did you photograph the utility entrances and controls outside the structure?

896. Please publish the photographs to the court.

897. Agree or disagree: Items of evidentiary value should be photographed at the scene.

898. Did you photograph each piece of evidence before moving it?

899. Agree or disagree: During the excavation of the debris strata, articles in the debris may or may not be recognized as evidence.

900. Agree or disagree: Photographs orient the articles of evidence in their original location as well as show their condition when found.
901. Agree or disagree: In all fires cases the minimum drawing should consist of a simple sketch.
902. Did you cause a simple sketch to be drawn of the fire scene?
903. Does your sketch of the fire scene include an elevation view?
904. Agree or disagree: Physical evidence should be thoroughly documented before it is removed. The diagramming and photography should always be accomplished before the physical evidence is moved or disturbed.
905. Did you thoroughly document the physical evidence before removing it?
906. Agree or disagree: Fire scene examination should not be undertaken alone.
907. Agree or disagree: A minimum of two individuals should be present.
908. Agree or disagree: Adequate debris removal is essential.
909. Agree or disagree: Inadequate removal of debris and the resultant exposure of only portions of the fire patterns can lead to gross misinterpretation of the fire patterns.
910. Do you always require the adequate removal of fire debris?
911. Did you come to the fire scene ready to thoroughly and completely sift through the fire debris?

912. What tools did you bring to the fire scene to thoroughly and completely sift through the fire debris?
913. Acceptance of what fact {A fire scene investigation involves dirty, strenuous work} is the first step in conducting a proper fire investigation?
914. Agree or disagree: The debris should be removed in layers with adequate documentation as the process continues.
915. Did you photograph the sifting of debris in layers?
916. How many standards are found in the National Fire Codes (290)?
917. Do you feel that you have had a fair chance to state all of your opinions or conclusions? If not, please complete your thoughts?
918. Was there lightning prior to the fire?
919. Would you agree that a fire investigator should ensure that due process of law is served?
920. Please list the different type of building construction that fire investigators are required to understand.
921. Do you meet the NFPA Standard for Professional Qualifications for Fire Investigators?
922. Who is the relevant scientific community for Professional Qualifications for Fire Investigators?
923. Do you accept the NFPA principal members of the NFPA Committee for

Professional Qualifications for Fire Investigators as authoritative on the subject of professional qualifications for fire investigators?

924. The professional qualification standards are written as JPR's, correct?
925. Do you meet the standards?
926. What does the acronym JPR (Job Performance Requirements) mean?
927. List each opinion you formulated in your investigation.
928. List all facts that support each opinion.
929. Did you make any assumptions regards "your" facts?
930. Have you made any assumptions?
931. Do you agree that we have all of the relevant facts for each of your opinions?
932. What is the basis of each assumption?
933. With respect to each opinion, give me an explanation of the reasoning process from facts to your conclusions?
934. With respect to each opinion, give us an explanation of the reasoning process from facts to conclusions?
935. Would you recite your formal education?

936. List all college and/or technical schools degrees earned.
937. Do you have a degree in fire investigation?
938. Do you have a degree in fire science?
939. How many courses in your degrees were titled "fire investigation"?
940. List seminars were you were taught about fire investigation.
941. List those professional organizations to which you are a member.
942. Are you a member of the National Fire Protection Association?
943. Are you a member of the National Association of fire Investigators?
944. Are you a biased fire investigation?
945. Do you refuse to except work for any particular group or position?
946. How many times have you testified by deposition or at trial?
947. How many times have you testified by deposition?
948. How many times have you testified live at trial?
949. What percent of fires that you investigate do you find to be arson?

950. What percent of fires that you investigate do you find to be accidental?
951. Have you ever been restricted from testifying?
952. How long were you on the scene during your investigation?
953. Is travel time included in your billing?
954. How long did it take for you to travel to the fire scene?
955. Based on your methodology and your experiences, is it important to you to go to the fire scene to properly investigate a fire loss?
956. Why?
957. List all smokers in the building.
958. Are your opinions based on your methodology?
959. Do you use some type of form, template or workbook to investigate fires?
960. Did you require the use of literature to investigate this fire loss?
961. Was this fire scene properly preserved?
962. Did you observe any conditions that adversely affected your investigation?
963. Was the fire scene disturbed by fire fighting operations?

964. What size fire hoses were utilized?
965. What type of fire nozzle was utilized in the extinguishment of this fire?
966. Did you observe any evidence whatsoever that the fire scene had been disturbed by the jet flow of any kind of hose?
967. Are you familiar with the scientific method and procedure in the investigation of fires?
968. Did you comply with the accepted method and procedure?
969. As a result of that accepted method and procedure, have you come to your expert opinions?
970. Who investigated the fire loss from the police or fire department?
971. Is most of your work done for or against insurance companies?
972. Were you told of the findings of the fire marshal before your arrival at the fire scene?
973. Did your client tell you of possible fire causes?
974. Please relate to the jury the generally accepted definition of the scientific method?
975. List the location and type of all possible ignitable liquids that were indigenous to the dwelling.
976. Where any of these possible ignition sources damaged during the fire?

977. Are you a fire scientist?
978. By the application of scientific principles, you intended to determine the source of ignition, precisely how this fire started; is that correct?
979. Did you issue a preliminary report to a oral report to your client?
980. In order to find the cause of a fire you must eliminate all other possible causes?
981. Was this fire difficult to investigate?
982. Did you require additional testing after leaving the fire scene so that you could find the fire cause?
983. Did you find the fire origin before you left the scene?
984. What is the scientific basis of your opinions?
985. Did others conduct any tests to support your methodology?
986. Are you aware of the use of canines specifically used to find ignitable liquids?
987. The dogs are recognized as a tool to be used by fire investigators, correct?
988. Canine Accelerant Detection Teams are recognized by the NFPA, correct?
989. Are Canine/Handler Teams commonly utilized by federal fire investigators?

990. Are Canine/Handler Teams commonly utilized by state fire investigators?
991. Are Canine/Handler Teams commonly utilized by city fire investigators?
992. Did you request the assistance of a Canine/Handler Team to assist in the investigation of this fire loss?
993. If the dogs found evidence of ignitable mixtures in the fire scene would that have supported your opinion?

994. If fact, positive alerts by the dogs would have been inconsistent to your opinions in this fire loss, correct?
995. Why not?
996. Have you ever taken the results of gas chromatography studies and applied those in a scientific manner to the determination of the origin and cause of a fire?
997. Are gas chromatograph results a tool used by fire investigators?
998. Did you utilize that tool in this investigation?
999. How much money did your client save by not using gas chromatograph testing?
1000. How much money did your client save by not using "combustible gas detectors" at the fire scene?
1001. How much money did you client save by not using canines at the fire scene?
1002. Could you have taken sample of fire debris and preserved them for testing later?
1003. Did you request the use of an engineer?
1004. Why?
1005. Did you find the fire cause before you left the scene?
1006. Did you perform any tests at the fire scene?

1007. Are you trained to perform tests at the fire scene?
1008. List each test and the purpose of each test that you have been trained to perform.
1009. Did you perform tests at any time before forming your opinions in this matter?
1010. Did you cause any tests to be performed before coming to your opinions?
1011. Please list all instances where you have testified on behalf of a person accused of setting a fire.
1012. List all cases that you have testified where you disputed arson.
1013. List all cases that you have testified where you disputed a finding of arson by a fire marshal.
1014. Would the majority of fire expert's peers agree with your stated opinions?
1015. Would a review of your photographs and report be sufficient for peer experts to come to the same conclusion as yourself?
1016. Is there any respected minority opinions in the field?
1017. Do you concede the legitimacy of minority or differing views in the fire investigation field?
1018. Did you base your investigation on your experience and training?

1019. Did you utilize "peer review" in your methodology?
1020. Did you have to read or study the literature before coming to your opinion?
1021. Have you considered or recommended any potential tests to support you methodology or technique?
1022. Who is the "relevant scientific community" in regards to your methodology in this fire analysis?
1023. What is the potential rate of error for your methodology or technique?
1024. Is it necessary for you, at times, to rely upon the work of others and to utilize subjective interpretation as well as some twenty years of experience in your methodology - correct?
1025. Do you feel that need to clarify any information given during your testimony today?
1026. Do you feel that you have had a fair chance to state all of your opinions or conclusions? If not, please complete your thoughts?
1027. Is there anything you would like to add so as not to be misunderstood?
1028. Have you understood all of my questions?
1029. Did your investigation utilize inductive reasoning?
1030. Did your investigation utilize deductive reasoning?
1031. Which do you utilize first? (inductive)

1032. Define inductive reasoning. (analyze the data)
1033. Define deductive reasoning. (Test the hypothesis)
1034. Define heat. (quantity)
1035. Define temperature. (intensity)
1036. What was the form of ignition?
1037. What was the source of heat?
1038. What was the ignition factor?
1039. What was the fire material ignited?
1040. When the fire department arrived was the fire fuel controlled or ventilation controlled?
1041. What is the basis of your opinion?
1042. Define fuel controlled.
1043. Define ventilation controlled.
1044. What forms of combustion were found in this fire? (flaming and smoldering)
1045. What are the two forms of combustion of solid materials?
1046. Did you eliminate natural fire causes?

1047. List all natural fire causes you considered.
1048. Did you eliminate spontaneous combustion?
1049. What elements are necessary for spontaneous combustion?
1050. What factors effected fire growth in the area of origin? (Ventilation opening, volume of the enclose, ceiling height, and location of the fire to corners or walls)
1051. Did this fire start against a wall?
1052. Did this fire start in the corner of a room?
1053. Why is that important to a fire investigator?
1054. What is the heat release rate of the fire material ignited?
1055. What was the flame height during the initial burning?
1056. What were the boundaries of the initial burn pattern? (15%)
1057. Detail the open doors with the structure?
1058. Did you observe charring patterns?
1059. Did you observe oxidation patterns?
1060. Did you observe patterns of consumption of combustibles?

1061. Did you observe smoke and soot deposits?
1062. Did you observe distortion patterns?
1063. Did you observe Melting patterns?
1064. Did you observe Color Change Patterns?
1065. Did you observe changes in the character of materials?
1066. Did you observe structural collapse?
1067. Did you observe flame movement patterns?
1068. Did you observe heat movement patterns?
1069. Is old dry wood more combustible than new kiln-dried wood? (No).
1070. Are you trained in measuring depth of char of wood?
1071. Where should measurement be taken – at the center of char blisters or near the crevasses between blisters? (center)
1072. Would you agree that consistency in the method of measuring the depth of char is the key to accurate figures?
1073. List the factors that effect the rate of charring of wood. (Rate and duration of heating; ventilation effects; surface area to mass ratio; direction, orientation, and size of wood grain; species of wood; moisture content; nature of surface coating)

1074. Can you identify a specific time of burning that can be determined based solely on depth of char? (No)
1075. List which windows were broken by the fire.
1076. What information is gained from annealed springs?
1077. What information is gathered from thick, oily soot on glass?
1078. Did you perform a depth-of-char Grid Diagram?
1079. Did you perform a fire scene reconstruction?
1080. List all potential ignition sources in the area of origin.
1081. What is the level of confidence that you regularly apply to your opinions as to cause?
1082. What is the level of confidence that you regularly apply to your opinions as to origin?
1083. List all hypotheses that you have developed in regards to your fire origin.
1084. List all hypotheses that you have developed in regards to your fire cause.
1085. Please explain in detail each hypotheses and your subsequent challenge.
1086. What is the insulation used on the electrical wire in the house?

1087. What temperature does the insulation on the wire flow? (PVC-347F)

1088. Does the insulation on wiring release corrosive gases?

1089. What corrosive gases are released? (hydrogen chloride)

1090. List the different types of electrical malfunctions that you considered during your analysis of the fire.

NFPA 921

1091. Are you aware of the reputation of Daniel Churchward in the fire investigation community? (Chairperson of the NFPA #921 Guide for Fire and Explosion Investigations – 1998)
1092. Richard Custer? (NFPA 921 – 1995 Chairperson) (Member 1998)
1093. John DeHaan? (Member; Author of *Kirk's Fire Investigation*)
1094. Bruce Ettlting? (Member; Author of IAAI Articles on Electrical Fires)
1095. David Smith? (Member; Atlantic City, N.J. F.D.)
1096. Joseph Toscano? (Member)
1097. Harold Nelson? (Member; FPE)
1098. John Lentini? (Member, Forensic Chemist)
1099. Does your professional library contain publications from the National Fire Protection Association?
1100. Do you rely upon such publications?
1101. Are you training in fire analysis?
1102. Were you trained to analyze fire thoroughly?

1103. Carefully?

1104. Completely?

1105. Systematic approach?

1106. Were you trained to complete all steps in the analysis of fires?

1107. Did you skip or add any steps in your analysis of this fire?

1108. Are you an expert on all of the steps in the analysis of fires?

1109. Is your analysis of this fire inconsistent with NFPA publications?

1110. Does your analysis of this fire lack any of the steps for fire analysis as documented in NFPA publications? (Receiving the assignment; Preparing for the Investigation; Conducting the Investigation; Collection and Preservation of Evidence; Analyzing the Incident)

1111. How many steps must be analyzed to complete the process of fire analysis? (6 steps in 92-921 and 95-921; 5 steps in 98-921 due to the combining of Scene Investigation and Recording sections)

1112. Did you analyze this fire carefully?

1113. Did you analyze this fire completely and thoroughly?

[Daubert/Robinson Challenge]

1114. Did you rely upon your training, education, and experience, to formulate your opinions in the analysis of this fire?

1115. Did you perform any tests before the formulation of your opinions?

1116. Have you performed formal tests to verify your burn pattern database?

1117. Can your theory of this fire be tested?

1118. Have you tested your methodology?

1119. Can you reference any formal testing of your burn pattern database?

1120. Can burn patterns be tested for validation?

1121. Are you a member of the International Association of Fire Investigators?

1122. Is your investigation of fires based on a "limited science"?

1123. Who is the relevant scientific community for the investigation of fires and explosions?

1124. Did your method of fire investigation rely upon a balance of subjective and objective interpretation of the data as well as an unbiased approach to the problem?

1125. Did you consider connective evidence in the formulation of your opinion as to cause and origin of the fire?

1126. Does your technique or methodology have a potential rate of error?

1127. Did your technique develop a potential rate of error?

1128. Is your technique developed for proper judicial application?

1129. Does your technique expand beyond judicial uses into non-judicial uses?

1130. Did you require assistance in the formulation of your opinions regarding this fire loss?

1131. List any text or publication within your custody at the fire scene.

1132. Did you require the assistance or reference of any publication before you could find the origin of this fire?

1133. Did you require the assistance or reference of any publication before you could find the cause of the fire?

1134. Did you require the assistance of any text or publication to complete your analysis of this fire?

1135. Was it necessary to subject your methodology to peer review?

1136. Can you list the steps you completed in the analysis of this fire?

1137. Define fire analysis.

1138. Did you perform a failure analysis of this fire loss? [Fire Analysis is the process of determining the origin, cause, development, and responsibility as well as the failure analysis of a fire or explosion.]

1139. Are you qualified in the determination of the origin of fires?

1140. Are you qualified in the determination of the cause of fires?

1141. Are you qualified to render opinions as to the development of this fire loss?

1142. Are you qualified to render opinions as to the responsibility for this fire?

1143. Are you qualified to render opinions as to the failure mode of this fire?

1144. Did you determine the origin of this fire?

1145. Did you determine the cause of this fire?

1146. Did you determine the development of this fire?

1147. Did you determine the responsibility of this fire?

1148. Did you determine the failure mode of this fire?

1149. Do you explain the difference between fire analysis and fire investigation?

1150. Would you describe this fire as a fuel-controlled fire or a ventilation-controlled fire?

1151. Would you agree that these are basic terms for an individual who performs a fire analysis?
1152. Would you rely upon an individual who lacks a understanding of these terms?
1153. Define fuel-controlled fire. (fuel-LIMITED fire. A fire in which the heat release rate and growth rate are controlled by the characteristics of the fuel, such as quantity and geometry, and in which adequate air for combustion is available.)
1154. Define ventilation-controlled fire. (Ventilation-LIMITED. A fire in which the heat release rate or growth is controlled by the amount of air available to the fire.)
1155. Would you characterize this fire as a smoldering fire? (Combustion without flame, usually with incandescence and smoke)
1156. Would you characterize this fire as a free-burning fire?
1157. Do you understand the term fire triangle? (heat, fuel, and oxygen)
1158. Do you understand the term fire tetrahedron? (heat, fuel, oxygen, and uninhibited chain reaction)
1159. Which term is consistent with a free-burning fire? (Fire Tetrahedron)
1160. Which term is consistent with a smoldering fire? (Fire Triangle)

CALCULATIONS

1161. Did you consider the fuel loading of the structure? (The term fuel load has been used in the past to indicate the potential severity of a fire and has been expressed in terms of Btu's or pounds of fuel per square foot of floor area. Fuel load is the total quantity of combustible contents of a building, space, or fire area, including interior finish and trim, expressed in heat units or the equivalent weight in wood. 1-3)

1162. Is that something you are trained to calculate?
1163. How is the answer expressed? (pounds per square foot, heat units or the equivalent weight in wood)
1164. What is the formula? (total weight divided by square feet)
1165. Please direct me to the proper literature for the answer?
1166. Does your methodology or technique include a consideration of "heat flux"?
1167. Are you trained to consider heat flux?
1168. Did you consider heat flux in your evaluation?
1169. What is the formula for calculating heat flux?
1170. Define heat flux. (The measure of the rate of heat transfer to a surface)
1171. What unit of measurement are expressed when calculating heat flux?
(kilowatts/m²; kilojoules/m²/second; or Btu/ft²/second)
1172. Did you calculate ignition energy?
1173. Have you ever made such a calculation?
1174. Approximately how many times?
1170. Do you know the formula?

1171. What are the units of measurement?
1172. Define ignition energy. (The quantity of heat energy that should be absorbed by a substance to ignite and burn)
1173. Did you calculate the heat release rate of the subject fire?
1174. What are the units of measurement? (Btu/sec or kilowatts)
1175. Define heat release rate. (The rate at which heat energy is generated by burning)
1176. Did you calculate flame height?
1177. Do you know how?
1178. What values are required to execute the formula? (Heat Release Rate and "k" value {location of the fire})
1179. What is the formula for flame height? [$H_f = 0.174 (kQ)^{0.4}$]
1180. What are the units of measurement? (meters or feet)
1181. Are you competent in the analysis of isochar diagrams?
1182. Did you perform the measurements for an isochar diagram?
1183. Have you developed isochar diagrams on other fire investigations?

- 1184.** What is the purpose of an isochar diagram? (direction and intensity of fire)
- 1185.** Define isochar. (A line on a diagram connecting points of equal char depth)
- 1186.** What was the predominate type of method of heat transfer at this fire loss? (usually convection)
- 1187.** Did you perform a complete examination of the electrical environment?
- 1188.** Did you inspect all of the wiring?
- 1189.** Did you trace the circuits?
- 1190.** Did you consider target fuel packages?
- 1191.** Define target fuel package. (A fuel that is subject to ignition by thermal radiation such as from a flame or a hot gas layer)
- 1192.** Would you list the target fuel packages that you considered in your investigation?
- 1193.** Which form of heat transfer usually causes the ignition of target fuel packages?
- 1194.** What is the first material ignited?
- 1195.** Did you consider thermal inertia?
- 1196.** Did you consider density of this material?

- 1197.** Did you consider the thermal conductivity of the material?
- 1198.** Did you consider the heat capacity of the material?
- 1199.** Did the total fuel load in this fire have any bearing on the rate of growth in its pre-flashover state? (NO)
- 1200.** Did this fire flashover?
- 1201.** Are you sure?
- 1202.** What physical evidence do you have of a flashover?
- 1203.** Did you calculate the ventilation opening for flashover?
- 1204.** How is the ventilation opening for flashover expressed? (HRR – Heat Release Rate in kilowatts or Btu's/second)
- 1205.** What is the formula? $[HRR_{fo} (kW) = (750A_o) (H_o)^{0.5} + 7.8A_o]$
- 1206.** What information is needed to make a consideration of ventilation opening for flashover? (area of the opening, square root of the height of the opening, and the area of the room)
- 1207.** Did you utilize smoke color as an indicator of what was burning? (NO)
- 1208.** What color was the smoke?
- 1209.** What information did you utilize from the color of the smoke? (None)

- 1210.** What are the two basic types of burn patterns delineated in the NFPA Standards. (Movement and Intensity)
- 1211.** Did you utilize depth of char to determine the duration of the burning? (Improper)
- 1212.** Does the rate of charring and burning of wood have a relation to its age? (NO)
- 1213.** Did you calculate the rate of heating?
- 1214.** What formulae did you utilize?
- 1215.** Did you calculate the duration of heating?
- 1216.** Did you consider the ventilation effects?
- 1217.** Did you consider the surface area to mass ratio of the first material ignited?
- 1218.** Did you consider the moisture content of the wood?
1219. Did you consider the nature of surface coating of the wood?
- 1220.** Which has a higher flame temperature – wood or gasoline? (gasoline 1879F and wood 1880F)
- 1221.** Are you holding yourself out to the court as a fire expert?

- 1222.** Has your testimony ever been excluded by a judge?
- 1223.** Are you an expert on heat?
- 1224.** Are you an expert on smoke?
- 1225.** Are you an expert on electricity?
- 1226.** Define fire. (A rapid oxidation process with the evolution of light and heat in varying intensities.)
- 1227.** Define heat. (A measurement of quantity of energy. A form of energy characterized by vibration of molecules and capable of initiating and supporting chemical changes and changes of state.)
- 1228.** Define temperature. (Molecular activity of a material compared to a reference point. A measurement of intensity.)

- 1229.** Define smoke. (Airborne particulate products of incomplete combustion suspended in gases, vapors, or solid and liquid aerosols.)
- 1230.** Define electricity. (Movement of electrons through a conductor.)
- 1231.** Define thermal inertia. (The properties of a material that characterize its rate of surface temperature rise when exposed to heat. Thermal inertia is related to the product of the material's thermal conductivity {k}; its density {rho or p}; and its heat capacity {c})
- 1232.** Define thermal conductivity. (The amount of heat that passes in unit time through a plate whose surfaces differ by one degree in temperature, with unit area and thickness)
- 1233.** Define heat capacity. (The amount of heat required to raise the temperature of a body one degree)
- 1234.** Define density. (The ratio of mass of an object to its volume)
- 1235.** Did you perform vector analysis during this investigation?
- 1236.** Have you been trained to perform vector analysis of fires?
- 1237.** Can you explain vector analysis to the court? (An arrow or vector used in a fire scene drawing to show the direction of heat, smoke, or flame flow)
- 1238.** Define volt. (The unit of electrical pressure (electromotive force) represented by the symbol E. The difference in potential required to make a current of one ampere flow through a resistance of one ohm.)
- 1239.** Define watt. (The unit of power or rate of work. This is equal to one joule per second, or the rate of work represented by a current of one ampere under the

potential of one volt)

- 1240.** Define ampere. (The unit of electrical current represented by the symbol "I").
- 1241.** Define ampacity. (The current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.)
- 1242.** Define Arc (A high-temperature luminous electric discharge across a gap.)
- 1243.** Define heat shadowing. (A pattern resulting from an object blocking the travel of radiated heat, convected heat, or direct flame contact from its source to the materials on which the pattern is produced.)

BASIC METHODOLOGY – Chapter 2

- 1244.** Did you utilize the scientific method?
- 1245.** Did you utilize deductive reasoning during your analysis of this fire?
- 1246.** Did you utilize inductive reasoning during your analysis of this fire?
- 1247.** Define deductive reasoning. (Analyze the data; reasoning from a known to an unknown)
- 1248.** Define inductive reasoning. (Testing the hypothesis)
- 1249.** Did you complete each of the steps?
- 1250.** What is the first step in the scientific methodology of fire investigation?
(Recognize the Need)
- 1251.** What is the second step in the scientific methodology of fire investigation?
(Define the problem)
- 1252.** What is the third step in the scientific methodology of fire investigation?
(Collect Data)
- 1253.** What is the fourth step in the scientific methodology of fire investigation?
(Analyze the Data – Inductive Reasoning)
- 1254.** What is the fifth step in the scientific methodology of fire investigation?
(Develop a Hypothesis)

- 1255.** What is the sixth step in the scientific methodology of fire investigation? (Test the hypothesis)
- 1256.** Agree or disagree: A fire or explosion investigation is a complex endeavor involving both art and science. (Agree)
- 1257.** Agree or disagree: ...the proper methodology for a fire or explosion investigation is to first determine and establish the origin(s), then investigate the cause. (Agree)
- 1258.** Agree or disagree: Until data have been collected, no specific hypothesis can be reasonably formed or treated. (Agree)
- 1259.** Agree or disagree: All collected and available data should be analyzed using the principles of the scientific method. An incident scenario or failure analysis should be described, explaining the origin, cause, fire spread, and responsibility for the incident. (Agree)
- 1260.** Do you have a basic understanding of combustion principles?
- 1261.** Once this fire reached a steady state, what was the dominant heat transfer property of thermal inertia? (Thermal conductivity)
- 1262.** Do you understand how fire can be suppressed by removing one of the sides of the fire tetrahedron?
- 1263.** Please list the four components of the fire tetrahedron.
- 1264.** Do you understand the fire tetrahedron?
- 1265.** How is a fire extinguished by removal of the "uninhibited chemical chain reactions"?

- 1266.** Wood will autoignite or spontaneously ignite by radiation at what temperature? (1112 F)
- 1267.** Wood will autoignite or spontaneously ignite by conduction at what temperature? (914 F)
- 1268.** Did you utilize or consider the total fuel load in the room and its bearing on the rate of growth of the fire in its pre-flashover phase? (No bearing)
- 1269.** Did this fire originate in a corner or against a wall?
- 1270.** What methods of heat transfer were manifest in the upper layer gases in this fire? (convection and radiation)
- 1271.** List all target fuel packages in the room of origin.
- 1272.** Agree or disagree: Smoke color is not necessarily an indicator of what is burning? (Agree)
- 1273.** Agree or disagree: The recognition, identification, and proper analysis of fire patterns by an investigator depends on an understanding of the dynamics of fire development and heat and flame spread. (Agree)
- 1274.** Agree or disagree: Each time another fuel package is ignited or the ventilation to the fire changes, the rate of energy production and heat distribution will change. (Agree)
- 1275.** Agree or disagree: Any burning item can produce a plume and thus a fire pattern. (Agree)
- 1276.** Would you agree that this fire burned with significant size and duration?
- 1277.** How long did this fire burn before it was extinguished?

- 1278.** The fire patterns are used to find the origin of the fire, correct?
- 1279.** The fire cause by its very nature must exist within the origin of the fire, correct?
- 1280.** If you cannot find the origin of the fire, then it follows, you cannot find the cause of the fire, correct?
- 1281.** Agree or disagree: Determining which pattern was produced at the point of origin by the first material ignited usually becomes more difficult as the size and duration of the fire increase. (Agree)
- 1282.** Did you examine the fire patterns at the fire scene?
- 1283.** Did you perform a partial or a complete examination of fire patterns?
- 1284.** Did you examine the fire scene for the surface effects of charring on the wood in this structure?
- 1285.** Do you know how to measure the char depth on wood?
- 1286.** Have you performed such calculations in the past during fire investigation?
- 1287.** Did you examine the depth of char in this fire?
- 1288.** Did you measure the depth of char in this fire?
- 1289.** Did you utilize depth of char measurements to assist in determining the duration of the burning?
- 1290.** Do you utilize the rule of one inch in 45 minutes for the rate of burning?

- 1291.** Is your purpose in measuring char to determine the approximate duration of the burning? (improper use of technique)
- 1292.** Did you consider the age of the wood when evaluating the charring and burning of the wood? (No relationship exists)
- 1293.** Is old dry wood more combustible than new kiln-dried wood assuming they both have been exposed to the same atmospheric conditions. (No.)
- 1294.** What is the key to accurate measurements of depth of char? (Consistency.)
- 1295.** Did you observe shiny, hump-backed alligatoring in this fire?
- 1296.** What information would you glean from shiny, hump-backed alligatoring? (None)
- 1297.** Define fire patterns. (Fire patterns are the visible or measurable physical effects that remains after a fire.)
- 1298.** Are you an expert on fire patterns?
- 1299.** What physical evidence do you have to support your opinion as to the origin of the fire?
- 1300.** What thermal effects, which cause burn patterns, did you consider during your examination of the fire scene? (charring, oxidation, consumption of combustibles, smoke and soot deposits, distortion, melting, color changes, changes in the character of materials, structural collapse.)
- 1301.** Did you examine oxidation patterns during your investigation?
- 1302.** Did you examine non-combustible materials for oxidation burn patterns?

1303. Can a non-combustible materials manifest oxidation burn patterns? (Yes. Lines of demarcation)

- 1304.** Are you proficient in the examination of oxidation burn patterns?
- 1305.** Did you inspect for melting patterns?
- 1306.** Did you inspect the window glass?
- 1307.** Did you inspect the scene for collapsed furniture springs?
- 1308.** Did you inspect broken or cracked window glass?
- 1309.** Did you examine thick, oily soot on the window glass?
- 1310.** Did you examine calcination?
- 1311.** Did you examine iron or steel in the fire scene?
- 1312.** Did you examine soot and char in the fire scene?
- 1313.** Did you observe stainless steel surfaces at the fire scene?
- 1314.** Did you observe galvanized steel in the fire scene?
- 1315.** Did you observe any rocks subject to high heat from the fire?
- 1316.** Did you inspect the windows for damage from the fire?
- 1317.** What type of damage to the windows did you observe?

- 1318.** Did you observe outside surface burn patterns?
- 1319.** Did you observe burn patterns on building contents?
- 1320.** Did you document "fall-down" or "drop down"?
- 1321.** Assume any situation where the presence of ignitable liquids is suggested that the NFPA recommends elimination of other effects. Do you disagree with this recommendation?
- 1322.** Do you properly eliminate fire effects before concluding the presence of ignitable liquids?
- 1323.** What other effects do you eliminate when you opine the presence of ignitable liquids? (flashover, airflow, hot gases, melted plastics, and building collapse)

- 1324.** What color does bare galvanized steel get with mild heating? (dull whitish surface)
- 1325.** What color does iron or steel become with mild heating? (blue-gray dullness?)
- 1326.** Are you competent to identify the physical effects of oxidation?
- 1327.** What physical effects of oxidation burn patterns do you seek during a fire investigation? (Change of color or texture)
- 1328.** Agree or disagree: The effects of oxidation include change of color and change of texture. (Agree)
- 1329.** Agree or disagree: The higher the temperature and the longer the time of exposure, the more pronounced the effects of oxidation. (Agree)
- 1330.** What color would a fire investigator find with the severe burning of stainless steel surfaces? (dull-gray surface)
- 1331.** Did you properly inspect copper conductors or wiring at the fire scene?
- 1332.** Agree or disagree: Copper forms a dark red or black oxide when exposed to heat. (Agree)
- 1333.** Is this color significant? (No.)
- 1334.** What is the color significant? (None)
- 1335.** Did you examine the thickness of any oxide layers on metal objects in the fire

scene?

- 1336.** Is the thickness of the oxide layer revealing to a properly trained fire investigator?
- 1337.** What does the thickness of the oxide layer reveal to a qualified fire investigator? (The thickness of the oxide can show greater fire conditions.)
- 1338.** Did you examine burn patterns created on metal appliance cabinets?
- 1339.** What information is gained from burn patterns on metal appliance cabinets? (fire origin and direction of travel)
- 1340.** When rocks are heated to high temperatures during a fire the rock often will change colors, correct?
- 1341.** What color will rocks usually change to when subjected to high temperatures? (yellowish to red)
- 1342.** What information is gained from the examination of such rocks? (fire intensity)
- 1343.** Is soot subject to oxidation? (Yes)
- 1344.** Is char subject to oxidation? (Yes)
- 1345.** What burn pattern is the result of the oxidation of soot and char? (Clean burn)
- 1346.** What information can be gleaned from the thickness of oxide on a non-combustible surface? (greater fire conditions)
- 1347.** Is the color formed on a non-combustible surface during oxidation significant to a qualified fire investigator? (No)

- 1348.** What is the importance? (None)
- 1349.** Is the demarcation formed during oxidation significant to a qualified fire investigator? (Yes)
- 1350.** What is the importance? (origin and direction of travel)
- 1351.** What was the "effective fire temperature" of this fire?
- 1352.** Would you describe the effective fire temperatures achieved in this fire elevated?
- 1353.** Identifiable temperatures achieved in structural fires rarely remain above what temperature? (1900 F, 1040 C)
- 1354.** What is the purpose of the analyzing of the melting and fusion of materials? (establishing whether higher than expected heat energy was present)
- 1355.** Do you find that the melting of certain metals may not always be caused by fire temperatures higher than the metals' stated melting point? (Yes – alloying will reduce the melting temperature of certain materials)
- 1356.** Did you observe alloying on any of the copper wiring in this fire?
- 1357.** Did you complete a thorough inspection of all of the electrical wiring in the fire?
- 1358.** Are you trained to recognize alloying on copper wiring?
- 1359.** Where did you receive such training?
- 1360.** Did you inspect for smoke condensates?

- 1361.** Did you observed any smoke condensates?
- 1362.** What colors are smoke condensates? (brown)
- 1363.** Are the lines of demarcation between clean burn and sooted areas valuable for the fire investigation?
- 1364.** Did you observe such patterns in this fire?
- 1365.** What information is revealed by an examination of the lines of demarcation between clean burn and sooted areas? (Direction of the fire spread or differences in intensity or time of burning.)
- 1366.** What two events produce clean burn? (direct flame contact or intense radiated heat)
- 1367.** Where do fire investigator search for calcination patterns? (plaster or gypsum {Sheetrock})
- 1368.** What information is gained from calcination patterns?
- 1369.** What is the effect of calcination? (drives the chemically bound water out of the gypsum)
- 1370.** What materials are embedded in the gypsum to preserve the strength of the wallboard during fire exposure? (mineral fibers or vermiculite particles)
- 1371.** The gypsum is exposed to fire it becomes gray, correct?
- 1372.** Why? (The charring of the organic binder and destiffener)

- 1373.** Does the gray color found in gypsum exposed to fire have significance to fire investigators such as yourself? (No)
- 1374.** Does the difference between colors have significance to fire investigators such as yourself? (Yes)
- 1375.** What causes glass windows to crack during fires?
- 1376.** Did you examine the window glass during your investigation?
- 1377.** Are there variables that affect the condition of glass after a fire? {yes}
- 1378.** Did you consider the variables that affect the condition of glass after the subject fire?

- 1379.** What variables that affect the condition of glass after fires did you consider during your investigation? (type of glass, thickness of glass, rate of heating, degree of insulation to the edges of the glass provided by the glazing method, degree of restraint provided by the window frame, history of the flame contact, and cooling history)
- 1380.** What causes glass windows to break and fall from the frames during a fire?
- 1381.** What temperature differentials between the center of the pane of glass and the protected edge are necessary to cause the glass window to crack? (158F)
- 1382.** If the pane of glass has no edge protection from radiated heat of fire, the glass will break at a higher or lower temperature? (Higher)
- 1383.** Did you observe glass fragments that were free of soot or condensates?
- 1384.** What phenomenon causes glass fragments to be free of soot or condensates after being subjected to a fire? (rapid heating, failure early in the fire, or flame contact)
- 1385.** Are pressures developed by fires in buildings sufficient to break glass windows? (No)
- 1386.** Did you inspect the glass at the scene for staining?
- 1387.** What factors affect the degree of staining? (The proximity of the glass to the area of origin or heat source and ventilation)
- 1388.** What pressures are required to break glass windows? (0.3 psi to 1.0 psi)
- 1389.** What pressures are exerted during fires? (0.002 psi to 0.004 psi)

- 1390.** What does the presence of a thick, oily soot on glass mean to you?
- 1391.** Can such staining be a result from the incomplete combustion of fuels such as wood and plastics? (Yes)
- 1392.** Did you observe collapsed furniture springs?
- 1393.** What information, if any, is revealed by the collapse of furniture springs? (direction, duration, or intensity of the fire)
- 1394.** What term do fire investigators use to describe the collapse of furniture springs? (annealing – the loss of tensile strength of the springs)
- 1395.** Are annealed springs consistent with slow, smoldering fires?
- 1396.** Are annealed springs consistent with a fast fire accelerated with an ignitable mixture?
- 1397.** What other circumstances or effects did you consider during your examination of the furniture? (loss of mass or depth of char to the frame; color changes, an indicator of intensity, in metal frames; and considerations of covering material of the springs)
- 1398.** Can certain types of patterns be used to locate the position of objects during the fire? (Yes - heat shadowing and protected areas)
- 1399.** Did you utilize such patterns during your investigation?
- 1400.** List the type of patterns you relied upon during your investigation to locate the position of objects. (heat shadowing and protected areas)
- 1401.** Does conducted heat produce heat shadowing? (No)

- 1402.** Define "heat shadowing". (The blocking by an object of the travel of radiated heat, convected heat, or direct flame contact from its source to the materials on which the pattern is produced.)
- 1403.** What is the purpose of the identification of protected areas and heat shadowing? (reconstruction of the fire scene)
- 1404.** Define "protected area". (An object preventing the products of combustion from depositing on the materials that the object protects, or prevents the protected material from burning.)
- 1405.** Did you photograph each important activity at the fire scene?
- 1406.** Did you reconstruct the fire scene?
- 1407.** Can you show us a photograph of the fire scene reconstruction?
- 1408.** Do you expect carpet to burn at fire scene?
- 1409.** Does carpet burn when exposed to flashover conditions? (yes - since the radiant heat flux that produces flashover exceeds the carpet's critical radiant flux)
- 1410.** Why do you take fire debris samples?
- 1411.** Is it your practice to secure fire debris samples on accidental fire scenes?

- 1412.** Do you take fire debris samples to indicate an ignitable liquid was not present?
- 1413.** What causes holes to be burned in wooden floors? (ignitable liquids, glowing embers, or the effects of flashover or full room involvement)
- 1414.** Have you been trained to recognize, identify, and analyze the thermal effects that cause burn patterns?
- 1415.** Did you carefully inspect the scene for thermal effects that cause burn patterns?
- 1416.** Was your inspection comprehensive?
- 1417.** Was your inspection complete?
- 1418.** Do you hold yourself out as an expert in the recognition, identification, and analysis of fire patterns as documented by the National Fire Protection Association?
- 1419.** During your investigation did you observe charring of the undersides of furniture?
- 1420.** What is the importance of charring of the undersides of furniture to a fire investigator? (Incendiary or flashover)
- 1421.** Is this fire pattern consistent with an incendiary fire using ignitable liquids to accelerate the fire? (Yes)
- 1422.** Is this fire pattern consistent with hot gas layer generated fire damage? (No)
- 1423.** Is this fire pattern consistent with damage generated by full room fire involvement? (Yes)

- 1424.** During your investigation did you observe burning of carpet under furniture?
- 1425.** What is the importance of uniform burning around table legs?
- 1426.** Is this fire pattern consistent with an incendiary fire using ignitable liquids to accelerate the fire?
- 1427.** Is this fire pattern consistent with hot gas layer generated fire damage?
- 1428.** Is this fire pattern consistent with damage generated by full room fire involvement?
- 1429.** During your investigation did you observe burning of baseboards?
- 1430.** What is the importance of burning of baseboards?
- 1431.** Is this fire pattern consistent with an incendiary fire using ignitable liquids to accelerate the fire?
- 1432.** Is this fire pattern consistent with hot gas layer generated fire damage?
- 1433.** Is this fire pattern consistent with damage generated by full room fire involvement?
- 1434.** During your investigation did you observe burning of the undersides of doors?
- 1435.** What is the importance of burning of the undersides of doors?
- 1436.** Is this fire pattern consistent with an incendiary fire using ignitable liquids to accelerate the fire?

- 1437.** Is this fire pattern consistent with hot gas layer generated fire damage?
- 1438.** Is this fire pattern consistent with damage generated by full room fire involvement?
- 1439.** During your inspection did you observe burning on floor coverings in corners?
- 1440.** What is the importance of burning on floor covering in corners?
- 1441.** Is this fire pattern consistent with an incendiary fire using ignitable liquids to accelerate the fire?
- 1442.** Is this fire pattern consistent with hot gas layer generated fire damage?
- 1443.** Is this fire pattern consistent with damage generated by full room fire involvement?
- 1444.** Is this fire pattern consistent with an incendiary fire using ignitable liquids to accelerate the fire?
- 1445.** Is this fire pattern consistent with hot gas layer generated fire damage?
- 1446.** Is this fire pattern consistent with damage generated by full room fire involvement?
- 1447.** List each of the burn patterns recognized by the NFPA literature that you identified in your fire investigation?
- 1448.** Did you carefully and thoroughly inspect the scene for the following burn patterns recognized by the NFPA:

- 1449. "V" burn patterns?
- 1450. "U" burn patterns?
- 1451. "Inverted V" burn patterns?
- 1452. "Hourglass" burn patterns?
- 1453. "Doughnut" burn patterns?
- 1454. "Saddle" burn patterns?
- 1455. "Pointer and Arrow" burn patterns?
- 1456. "Linear" burn patterns?
- 1457. "Area" burn patterns?
- 1458. "Pulled Light" burn patterns?
- 1459. "Trailer" burn patterns?
- 1460. "Heat Shadowing" burn patterns?
- 1461. "Protected Area" burn patterns?
- 1462. "Circular" burn patterns?

1463. Did you eliminate the following burn patterns during your investigation:

1464. "V" burn patterns?

1465. "U" burn patterns?

1466. "Inverted V" burn patterns?

1467. "Hourglass" burn patterns?

1468. "Donut" burn patterns?

1469. "Truncated Cone" burn patterns?

1470. "Saddle" burn patterns?

1471. "Pointer and Arrow" burn patterns?

1472. "Linear" burn patterns?

1473. "Area" burn patterns?

1474. "Pulled Light" burn patterns?

1475. "Trailer" burn patterns?

1476. "Material Distortion" burn patterns?

1477. "Circular" burn patterns?

1478. Explain what information is provided by the documentation of the following burn patterns:

1479. "V" burn patterns? (Flames, convective or radiated heat from hot fire gases, and smoke within the fire plume.)

- 1480.** "U" burn patterns? (U-shaped patterns are created by the effects of radiant heat energy on the vertical surfaces more distant from the same heat source than surfaces displaying sharp V patterns. The lowest lines of demarcation of the U patterns are generally higher than the lowest lines of demarcation of corresponding V patterns that are closer to the fire source.)
- 1481.** "Inverted V" burn patterns? (The fuel package is against the vertical surface, i.e., wall. The flame zone is shaped like an inverted "V" and the hot gas zone as a "V")
- 1482.** "Hourglass" burn patterns? (The plume of hot gases above a fire is composed of a hot gas zone shaped like a V and a flame zone at its base. The flame zone is shaped like an inverted V.)
- 1483.** "Doughnut" burn patterns? (When a liquid causes this pattern, it is due to the effects of the liquid cooling the center of the pool as it burns while flames at the perimeter of the doughnut produce charring of the floor or floor covering. Consistent of ignitable liquids.)
- 1484.** "Truncated {interception} Cone" burn patterns? (Three-dimensional fire plume patterns on the wall and ceiling.)

- 1485.** "Saddle" burn patterns? (U- or saddle-shaped patterns that are sometimes found on the top edges of floor joists caused by the fire burning downward. Saddle burns display deep charring, and the fire patterns are highly localized and gently curved.)
- 1486.** "Pointer and Arrow" burn patterns? (These fire patterns are commonly displayed on a series of combustible elements such as wooden studs or furring strips of walls whose surface sheathing has been destroyed by fire or was nonexistent)
- 1487.** "Linear" burn patterns? (Patterns that have overall linear or elongated shapes can be called linear patterns. They usually appear on horizontal surfaces)
- 1488.** "Area" burn patterns? (Some patterns may appear to cover entire rooms or large areas without any readily identifiable sources or beginnings. These patterns are most often formed when the fuels that create them are widely dispersed before ignition, or when the movement of the fire through the areas is very rapid as in a flash fire.)
- 1489.** "Linear" burn patterns? (Usually found on horizontal surfaces)
- 1490.** "Pulled Light" burn patterns? (Incandescent light bulbs can sometimes show the direction of heat impingement {or point to the origin of the fire}. As the side of the bulb facing the source of heating is heated and softened the gases inside a bulb of greater than 25 watts can begin to expand and bubble out of the softened glass. Response of internal pressure except 25 watts or less as it is under a vacuum and pulls inward.)
- 1491.** "Trailers"? (fuels intentionally distributed from one area to another)
- 1492.** "Area" Patterns (Cover entire rooms or large areas without any readily identifiable sources or beginnings. Widely dispersed before ignition or flash fire)
- 1493.** "Material Distortion" Patterns (Physical change of shape and distortion of some objects that are subjected to the heat of the fire.)
- 1494.** "Circular" Patterns. (Damage to the ceiling. Locate the center and seek heat

source directly below)

- 1495.** Explain how the following burn patterns are created by the fire:
- 1496.** "V" burn patterns?
- 1497.** "U" burn patterns?
- 1498.** "Inverted V" burn patterns?
- 1499.** "Hourglass" burn patterns?
- 1500.** "Donut" burn patterns?
- 1501.** "Saddle" burn patterns?
- 1502.** "Pointer and Arrow" burn patterns?
- 1503.** "Linear" burn patterns?
- 1504.** "Area" burn patterns?
- 1505.** "Pulled Light" burn patterns?"
- 1506.** "Trailer"
- 1507.** "Material Distortion"
- 1508.** "Circular"

- 1509.** What elements of the fire create the angle of "V" patterns? (HRR and geometry; ventilation; ignitability of the vertical surface; and interceding horizontal surfaces such as shelves, table tops, etc.)
- 1510.** Agree or disagree: A wide "V" pattern indicates a slowly growing fire. (Disagree)
- 1511.** Agree or disagree: A narrow "V" pattern indicates a rapidly burning fire. (Disagree)
- 1512.** What type of flame plumes are caused by inverted cones? (vertical flame plumes)
- 1513.** Agree or disagree: The correct analysis of inverted cone patterns is that the burn was of long duration. (Disagree – relatively short duration)
- 1514.** Agree or disagree: Is it more likely that the inverted cone pattern will appear on combustible surfaces. (Disagree – non-combustible surfaces)
- 1515.** Leaking natural gas is prone to the production of what type of burn patterns? (inverted cone burn patterns)
- 1516.** Agree or disagree: If there are two patterns from the same heat source, the one with the lower vertex will be closer to that heat source. (Agree)
- 1517.** Agree or Disagree: Many fire movement patterns, such a V patterns, U patterns, circular patterns, and pointer or arrow patterns, are related directly to the three-dimensional "cone" effect of the heat energy created by a fire. (Agree)
- 1518.** What type of burn patterns can be created when a plume is truncated by a vertical plane, such as a wall surface. ("V and U")
- 1519.** Did your fire origin contain a plume?

- 1520.** What type of burn pattern is created from the hot gas portion of the plume? (Upright V)
- 1521.** What type of burn pattern is created from the flame zone? (Inverted V)
- 1522.** Did you consider airflow in the vicinity of the plume and its effect on the burn patterns?
- 1523.** Did you consider that airflow could modify the angles of the burn patterns in the subject fire?
- 1524.** Can airflow cause the plume to become unstable? (Yes)
- 1525.** What effect does airflow in the vicinity of the plume have upon the angle of the "V" burn pattern? (larger angles than normal 15 degrees)
- 1526.** Did you inspect for holes in the floor?
- 1527.** What causes holes in wooden floors? (glowing combustion, radiation, or an ignitable liquid)
- 1528.** Did you inspect the doors?
- 1529.** What characteristics are you trained to examine?
- 1530.** Did you inspect for the position of the doors?

- 1531.** Agree or disagree: Areas of great damage are indicators of a high heat release rate, ventilation effects, or long exposure. (Agree)
- 1532.** Did you inspect the undersides of furnishings?
- 1533.** Did you observe damage to the undersides of furnishings?
- 1534.** Does heat generated from the hot gas layer cause damage to the undersides of furnishings? (No)
- 1535.** Does full room involvement of fire cause damage to the undersides of furnishings? (Yes)
- 1536.** Do non-combustible surfaces manifest burn patterns?
- 1537.** Are you trained to examine non-combustible surfaces for burn patterns?
- 1538.** List burn patterns that you look for when examining non-combustible surfaces. (color changes, oxidation, physical distortions, or melting)
- 1539.** Did you examine the fire scene for penetrations of horizontal surfaces?
- 1540.** What events can cause penetrations of horizontal surfaces? (radiant heat, direct flame impingement, or localized smoldering)
- 1541.** Do you accept the possibility that fire can move upward or downward? (Yes)
- 1542.** The origin of the fire must be found first before finding the fire cause, correct?
- 1543.** Fire investigators find fire origins by analyzing burn patterns, correct?

- 1544.** If the fire investigator cannot read burn patterns then the origin cannot be documented, correct?
- 1545.** No origin – no cause, correct?
- 1546.** Do you hold yourself out as an expert on fire patterns?
- 1547.** What are the two basic types of fire patterns documented by the National Fire Protection Association? (movement and intensity)
- 1548.** Did you examine paint that had been charred or darkened?
- 1549.** What causes paint to char or darken? (binder)
- 1550.** Are you trained to evaluate the degree of discoloration and charring and compare them to adjacent areas?
- 1551.** Did you perform this task at the subject fire?
- 1552.** What is the importance of comparing the degree of discoloration and/or charring in the adjacent areas? (Locating the areas of greatest burning)
- 1553.** What is the purpose of drawing isochar diagrams? (lines of demarcation may be identified)
- 1554.** What are the key variables that affect the validity of depth of char pattern analysis? (Single versus multiple heat or fuel sources; comparison of char measurements of identical materials; ventilation, and consistency of measuring technique and method)
- 1555.** What part of the alligating are to be used for measurement? (center)

- 1556.** Do you examine the scene for the presence of large shiny alligatoring?
- 1557.** Did you find evidence of large shiny alligatoring?
- 1558.** Is that the kind of evidence that is proof that an ignitable liquid was present during the fire? (No)
- 1559.** Can you list variables to the rattle of charring of wood? (rate and duration of heating; ventilation; surface area to mass ratio; direction, orientation, and size of wood grain; species of wood; moisture content; and nature of surface coating.)
- 1560.** Did you examine the fire scene for spalling? (*Note: NOT "Spaulding" like the baseball)
- 1561.** Are you competent to identify and analyze spalling at a fire scene?
- 1562.** Did you inquire about pre-existing spalling?
- 1563.** Define spalling. (breakdown in surface tensile strength of concrete, masonry, or brick caused by exposure to high temperatures and rates of heating resulting in mechanical forces with the materials)
- 1564.** What events can cause spalling? (heat, freezing, chemical, or abrasion)
- 1565.** What is the importance of spalling to the fire investigator? (documentation and analysis of a heat source)
- 1566.** What is the primary mechanism of spalling? (expansion or contraction of the surface while the rest of the mass expands or contracts at a different rate.)
- 1567.** Did you observe spalled areas that appeared lighter in color than adjacent areas?

- 1568.** What causes lightening of spalled areas in concrete? (exposure of clean subsurface material. Adjacent areas may also tend to be sooted.)
- 1569.** Did you consider the production of lines and areas of demarcation during your investigation?
- 1570.** Are you skilled in the interpretation of fire patterns caused by lines or areas of demarcation?
- 1571.** List the variables that effect the production of lines and areas of demarcation, and the subsequent fire patterns that they define. (Variables: the materials itself, the rate of heat release of the fire, fire suppression activities, temperature of the heat source, ventilation, exposure)
- 1572.** Did you inspect the shapes and nature of the fire patterns?
- 1573.** Are you competent in the interpretation of the shape and nature of fire patterns generated during fires?
- 1574.** What event has the most influence on the shape and nature of fire patterns? (nature and material of the surface)
- 1575.** Did you observe rough surfaces during your investigation?
- 1576.** Did you observe smooth surfaces during your investigation?
- 1577.** Smooth and rough surface areas of the same materials burn differently, correct?
- 1578.** Please define the difference in burning characteristics of smooth and rough surface areas of the same materials. (the rougher surface will sustain more damage)

- 1579.** What is the scientific basis for the difference in burning characteristics of smooth and rough surface areas of the same materials? (...turbulence of the hot gases interacting with the surface as well as a increase in the surface to mass ratio)
- 1580.** Is the phenomena of pyrolysis important to fire investigators?
- 1581.** Did you consider pyrolysis during your investigations?

- 1582.** Define pyrolysis. (The transformation of a compound into one or more substances by heat alone. The decomposition of matter through heat.)
- 1583.** What physical evidence is observed during an pyrolytic reaction? (surfaces darkened; various stages of charring, or the total loss of material)
- 1584.** Did you inspect metal construction elements?
- 1585.** Materials with higher coefficient of thermal expansion are more or less prone to heat distortion? (more)
- 1586.** Agree or disagree: Whatever the capacity in which a fire investigator functions (private or public), it is important that the investigator be informed regarding all relevant legal restrictions, requirements, obligations, standards, and duties. Failure to do so could subject the investigator to civil liability or criminal prosecution. (Agree)
- 1587.** Agree or disagree: Once a legal right of entry onto the property has been established, the investigator should notify the officer or authority in charge of the scene of his or her entry. (Agree)

- 1588.** Agree or disagree: The investigator should exercise caution and not destroy, dispose of, or remove any evidence unless clearly and legally entitled to do so. (Agree)
- 1589.** Was your entry into the fire scene consistent with N.F.P.A. Standards and Guidelines?
- 1590.** Do you know the NFPA recognized general methods by which entry may be obtained? (consent, exigent circumstance, administrative search warrant, and criminal search warrant)
- 1591.** What was the basis of your entry onto this fire?
- 1592.** Are you competent in the recognition of evidence at a fire scene?
- 1593.** Do you recognize that there are different types of evidence recognized by the NFPA and the fire community?
- 1594.** Did you thoroughly examine the fire scene for these different types of evidence?
- 1595.** What types of evidence are recognized by the NFPA? (Demonstrative, documentary, and testimonial)
- 1596.** Did you identify demonstrative evidence at the subject fire scene?
- 1597.** Did you identify documentary evidence at the subject fire scene?
- 1598.** Did you identify testimonial evidence at the subject fire scene?
- 1599.** Define demonstrative evidence. (tangible items – It is evidence from which one can derive a relevant firsthand impression by seeing, touching, smelling, or heating the evidence.)

- 1600.** Are you trained to authenticate demonstrative evidence?
- 1601.** Are you trained to authenticate demonstrative evidence?
- 1602.** Are you trained to authenticate testimonial evidence?
- 1603.** How do you authenticate demonstrative evidence? (recognition testimony or establishing a chain of custody)
- 1604.** Define documentary evidence. (written form)
- 1605.** Define testimonial evidence. (competent live witness speaking under oath)
- 1606.** How do you authenticate documentary evidence?
- 1607.** How do you authenticate testimonial evidence?
- 1608.** The fact that an investigator has authority to conduct an investigation does not necessarily mean that he or she has the legal right to enter the property that was involved in the fire, correct?
- 1609.** Once a legal right of entry onto the property has been established, who should the investigator should notify? (the officer or authority in charge of the scene of his or her entry)
- 1610.** Did you notify the authority having jurisdiction of your intention to enter the fire scene?
- 1611.** Who was the authority having jurisdiction of this fire?
- 1612.** The investigator should exercise caution and not destroy, dispose of, or

remove any evidence unless clearly and legally entitled to do so, correct?

- 1613.** There are four methods in which entry into a fire scene can be obtained, correct?
- 1614.** Did you make your entry within the guidelines of NFPA?
- 1615.** List the four methods in which entry into a fire scene can be obtained.
- 1616.** According to the NFPA what allegation provides the basis for the majority of civil lawsuits? (negligence)
- 1617.** Is it your opinion that my client was this matter?
- 1618.** Did you establish the elements of negligence in this fire loss?
- 1619.** Define negligence. (Situations in which a person has not behaved in the manner of a reasonably prudent person in the same or similar circumstances)
- 1620.** List the elements required to be documented for legal liability for negligence. (Duty, Failure, Cause, and Loss)
- 1621.** Have you documented code violations in this fire loss?
- 1622.** Have you documented any violations of regulations, rules, order, or standards in this fire loss?
- 1623.** Define *product liability* as per NFPA? (Legal liability of manufacturers and sellers to compensate buyers, user, and even bystanders for damages or injuries suffered because of defects in goods purchased)

- 1624.** Are you experienced in the identification of design defects?
- 1625.** Are you experienced in the identification of manufacturing defects?
- 1626.** Are you experienced in the identification of inadequate warnings?
- 1627.** Did you document weather conditions as per NFPA?
- 1628.** What was the wind direction?
- 1629.** What was the wind velocity at the time of the fire?
- 1630.** What was the temperature at the time of the fire?
- 1631.** Was it raining at the time of the fire?
- 1632.** Did it rain during the week previous to the fire?
- 1633.** What is the purpose of documented the weather conditions? (they can all have an effect on the ignition and fire spread)
- 1634.** Did you perform the basic functions of a fire investigation as documented by the NFPA?
- 1635.** List the basic functions of a fire investigation as per NFPA.
(leadership/coordinating functions, photograph, note taking, mapping, diagramming, interviewing witnesses, evidence collection and preservation and safety assessment)
- 1636.** It should be kept in mind that fire investigation is a specialized field, correct?

- 1637.** Those individuals not specifically trained and experienced in the discipline of fire investigation and analysis even though they may be expert in related field, may not be well qualified to render opinions regarding fire origin and cause, correct?
- 1638.** Forensic laboratories are recognized by the NFPA as a basic aid to the investigation of fires, correct?
- 1639.** Combustible gas detectors or "sniffers" are recognized by the NFPA as a basic aid to the investigation of fires, correct?
- 1640.** Canine Teams are recognized by the NFPA as a basic forensic tool in the investigation of fires, correct?
- 1641.** Did you utilize a forensic laboratory during your investigation of this fire?
- 1642.** Did you utilize a combustible gas detector during your investigation of this fire?
- 1643.** Did you utilize a Canine Team during your investigation of this fire scene?
- 1644.** Does your company commonly utilize a forensic laboratory?
- 1645.** Does your company have access to a combustible gas detector?
- 1646.** Generally, information is available to the investigator in four forms, correct?
- 1647.** Did you utilize all four forms of information during your investigation of this fire loss?
- 1648.** List the four forms of information available to the investigator.

- 1649.** Did you properly prepare to interview witnesses?
- 1650.** What is the most important aspect of the preparation to interview witnesses?
(understanding of all facets of the investigation)
- 1651.** What type of witnesses, as per NFPA, did you interview in this case?
(approach with trust, caution, and distrust)
- 1652.** List any and all design defects that you identified.
- 1653.** List any and all manufacturing defects that you identified.
- 1654.** List any and all inadequate warnings that you identified.
- 1655.** Define design defect.
- 1656.** Define manufacturing defect.
- 1657.** Define inadequate warnings.
- 1658.** Who is responsible during the course of a fire investigation for locating, collecting, identifying, storing, examining, and arranging for testing of physical evidence. (the fire investigator)
- 1659.** The decision on what physical evidence to collect at the incident scene for submission to a laboratory or other testing facility for examination and testing, or for support of a fact or opinion, rests with the fire investigator, correct?
- 1660.** Did you examine the fire scene for physical evidence?

- 1661.** Do you hold yourself out as an expert on physical evidence at a fire scene?
- 1662.** Define physical evidence. (any physical or tangible item that tends to prove or disprove a particular fact or issue)
- 1663.** Generally, the cause of a fire or explosion is not known until near the end of the investigation, correct?
- 1664.** Do you consider the entire fire scene physical evidence and protect and preserve it as such? (Yes)
- 1665.** Do you have any complaints about the effectiveness of the fire suppression activities of the fire department?
- 1666.** It is during what point during fire suppression activities that any remaining evidence not damaged by the fire is susceptible to being destroyed or displaced? (overhaul)
- 1667.** Is it important for fire investigators to document the position of electrical breakers at the time of the fire?
- 1668.** Why?
- 1669.** Where you trained to document position of the electrical breakers at the time of the fire?
- 1670.** What is the importance of checking the position of the electrical breakers at the time of the fire?
- 1671.** Did fire fighters turn any knobs or operate any switches or breakers?
- 1672.** How do you know?

- 1673.** Did you interview or cause to be interviewed any of the fire fighters?
- 1674.** Did anyone from the fire marshal's officer change any position of the electrical breakers before your arrival?
- 1675.** Was any fuel-powered equipment used in the fire scene?
- 1676.** Is that something that you normally inquire about during your fire investigations?
- 1677.** What common fuel-powered equipment is used in fire scenes? (positive pressure ventilation fans)

- 1678.** Are you trained to secure fire debris evidence at the fire scene?
- 1679.** How many samples did you secure last year?
- 1680.** Discuss your sampling methodology?
- 1681.** Do you commonly have fire debris analyzed for ignitable liquid residues?
- 1682.** Do you require your debris analysis to be in compliance with American Society of Testing Materials Standards?
- 1683.** What standards apply to the testing and identifications of ignitable liquid residues? (ASTM E-1387 Standard Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography and ASTM E-1618 Standard Guide for Identification of Ignitable Liquid Residues in Extracts from Samples of Fire Debris by Gas Chromatography - Mass Spectrometry.)
- 1684.** Are you aware of the NFPA position on the utilization of canine/handler teams? (Properly trained and validated ignitable liquid detection canine/handler teams have proven their ability to improve fire investigations by assisting in the location and collection of samples for laboratory analysis for the presence of ignitable liquids)

- 1685.** Are you competent in the use of canine/teams at fire scenes?
- 1686.** When securing evidence the diagramming and photography of evidence should be accomplished before movement?
- 1687.** Who is responsible for maintaining a list of the evidence secured at the fire scene?
- 1688.** Are you competent in securing samples of ignitable liquids from porous material, such as a concrete floor?
- 1689.** How do you secure samples from porous material such as a concrete floor?
- 1690.** What absorbent materials are used to sample concrete? (lime, diatomaceous, and non-self-rising flour)
- 1691.** What is the proper use of canine/handler teams? (...to assist with the location and selection of samples)
- 1692.** Is the canine olfactory system capable of detecting gasoline at concentrations below those normally cited for laboratory methods? (Yes)

- 1693.** Are you competent in the collection of gaseous samples?
- 1694.** What methods are available to collect gaseous samples? (Mechanical sampling devices; evacuated air-sampling can; and bottle of distilled water)
- 1695.** Are you competent in securing and documenting electrical samples?
- 1696.** How do you document electrical components? (Photographed and diagrammed)
- 1697.** What is the recommended container for the collection of liquid and solid accelerant evidence? (unused, clean metal can)
- 1698.** How much air space is required above the debris for proper analysis (1/3 air - 2/3 debris)
- 1699.** All evidence should be marked or labeled for identification at the time of collection, correct?
- 1700.** What are the chief sources of degradation of most kinds of evidence? (heat, sunlight, moisture)

CHAPTER 10 – SAFETY

- 1701.** What is the NFPA minimum manpower requirement for the investigation of a fire scene? (A minimum of two individuals should be present to ensure that assistance is at hand if an investigator should become trapped or injured.)
- 1702.** Did you investigate the fire scene with the proper safety equipment as specified by the NFPA? (safety shoes or boots, gloves, safety helmet, and protective clothing, such as overalls or turnout gear - should be worn at all times while investigating the scene.)
- 1703.** When conducting an investigation in a structure soon after the fire is believed to be extinguished, the investigator should be mindful of what possibility? (rekindle)

ORIGIN DETERMINATION – Chapter 11

- 1704.** Generally, if the origin of a fire cannot be determined, the cause cannot be determined, correct?
- 1705.** NFPA recognizes three types of information to find the origin, correct?
- 1706.** What three types of information are recognized by the NFPA as the basis of determining the origin of a fire? (fire patterns, observations, and analysis of the physics and chemistry of fire initiation, development, and growth)
- 1707.** In some instances, a single item, such as an irrefutable article of physical evidence or dependable eyewitness to the initiation, can be the basis for a conclusive determination of origin.
- 1708.** Do you claim such a single item of physical evidence as the basis for a conclusive determination of origin?
- 1709.** Do you claim such a single item such as a dependable eyewitness to the initiation of the fire?
- 1710.** What is the level of confidence in your origin of the fire?
- 1711.** Is it important that the determination of a single point of origin not be made unless the evidence is conclusive? (Yes)
- 1712.** The area of origin is almost always determined by examining the fire scene, starting with the areas of least damage and moving toward the areas of greatest damage, correct?
- 1713.** The purpose of determining the origin of the fire is to identify the geographical location where the fire began, correct?

- 1714.** Did you follow the NFPA recommended procedure for the examination of the fire scene?
- 1715.** What are the steps in the NFPA recommended procedure for the examination of the fire scene? (preliminary scene examination, development of a preliminary fire-spread scenario, an in-depth examination of the fire scene, a fire scene reconstruction, development of a final fire-spread scenario, and identification of the fire's origin.)
- 1716.** Are you taught to make notes during this procedure?
- 1717.** Did you make such notes?
- 1718.** Have you produced those notes?
- 1719.** Did you develop a vector diagram for this fire?
- 1720.** Are you competent to develop vector diagrams?
- 1721.** What type of variable form the basis for a vector diagram?
- 1722.** Did you develop a vector diagram for fire temperatures?
- 1723.** Did you develop a vector diagram for duration of heating?
- 1724.** Did you develop a vector diagram for heat flux?
- 1725.** Did you develop a vector diagram for intensity?
- 1726.** What is a vector diagram for fire temperatures?

1727. What is a vector diagram for duration of heating?

1728. What is a vector diagram for heat flux?

1729. What is a vector diagram for fire intensity?

- 1730.** Have you ever draw a vector diagram for fire temperatures?
- 1731.** Have you ever draw a vector diagram for duration of heating?
- 1732.** Have you ever draw a vector diagram for intensity?
- 1733.** Have you ever draw a vector diagram for heat flux?
- 1734.** What is the purpose of complimentary vectors in fire pattern analysis? (show actual heat movement directions)
- 1735.** Are the following terms synonymous: source of heat, fire origin, and heat source? (No)
- 1736.** Did you record any depth-of-char surveys?
- 1737.** Are you competent in the production of depth-of-char surveys?
- 1738.** Are you trained to document all rooms and areas of the structure?
- 1739.** Was the site altered before your arrival?
- 1740.** Who has altered the scene before your arrival?
- 1741.** Did you interview anyone who altered the site as to the extent of their alterations and the documentation they may have of the unaltered site?
- 1742.** The development of the preliminary scenario is a critical point in the investigation, correct? (Yes)

- 1743.** Did you document the meter readings for the utilities?
- 1744.** Did you document the remains of each exterior door?
- 1745.** An interior surface examination generally is performed before any attempt is made to formulate an opinion as to fire origin, correct?
- 1746.** Did you document the housekeeping of the loss? (housekeeping, or lack of it, should be noted)
- 1747.** If an area of origin is identified, then all potential ignition sources should be located and identified for a further reduction of the area of origin to a point of origin, correct?
- 1748.** Is this fire loss a "total burn"?
- 1749.** Did you examine the contents of the loss?
- 1750.** What is the purpose of the examination of the contents? (...determine whether the noncombustible contents found correspond to the type and amount of contents expected in a structure of the same occupancy; note the differing degrees of heating effects on them)

CAUSE DETERMINATION – Chapter 12

- 1751.** What was the ignition source of this fire?
- 1752.** What was the heat source of this fire?
- 1753.** What was the type of material first ignited?
- 1754.** What was the form of the material first ignited?
- 1755.** What human acts/omissions were responsible for this fire loss?
- 1756.** List all heat sources considered and the reason for the elimination of same.
- 1757.** Are you competent in the classification of fire causes?
- 1758.** List the different categories of fire causes? (accidental, natural, incendiary {arson}, and undetermined)
- 1759.** The heat source should be identified in order for the cause to be proven, correct?
- 1760.** Are you trained to obtain information from owners or occupants about what potential ignition sources were in the area of origin, how and when they were used, and recent activities in the area?
- 1761.** List all potential ignition sources in your area of origin.
- 1762.** List all potential ignition sources in the origin of the opposing experts.

- 1763.** If I light a wooden match and start a fire in a sofa made of polyurethane, what is the form of material first ignited? (polyurethane foam)
- 1764.** If I light a wooden match and start a fire in a sofa made of polyurethane, what is the type of material first ignited? (sofa covering)
- 1765.** List all hypothesis considered.
- 1766.** What assumption did you make?
- 1767.** Did you secure a fire debris sample for analysis by a forensic laboratory?
- 1768.** How many fire debris samples did you have analyzed last year?
- 1769.** What laboratory did you submit your samples?
- 1770.** Are you trained to interpret the results from the forensic laboratory?
- 1771.** Did you secure a comparative sample?
- 1772.** What literature do you rely upon for the proper securing of fire debris samples?

EXPLOSIONS – Chapter 13

- 1773.** Did you inspect the scene for damage caused by an explosion?
- 1774.** Did you carefully and completely inspect the scene for damage caused by an explosion?
- 1775.** Describe any damage caused by an explosion?
- 1776.** Did you eliminate an explosion during your investigation?
- 1777.** Did an explosion cause this fire?
- 1778.** Was there an explosion during this fire?
- 1779.** Do you feel that you are qualified to investigate an explosion?
- 1780.** Are you as qualified to investigate a fire as an explosion?
- 1781.** Is your skill level at explosion investigation less than your skill level at fire investigation?
- 1782.** Do you hold yourself out to this court as an expert in the investigation of fires?
- 1783.** Do you hold yourself out to this court as an expert in the investigation of explosions?
- 1784.** Are you trained in the basics of investigating explosions?

- 1785.** Would you describe your skill in the investigation of explosions as basic, intermediate, or advanced?
- 1786.** Have you determined fire to be caused by an explosion?
- 1787.** Do you commonly eliminate explosions during your fire investigation?
- 1788.** How many fires have you investigated in your career?
- 1789.** How many fires have you found to be caused by an explosion?
- 1790.** How many fires have you eliminated an explosion as a possible fire cause?
- 1791.** List all cases you have been wrong on your opinion as to an explosion?
- 1792.** How many fires have you mis-called during your career?
- 1793.** Have you ever, in your career, written a supplemental report or document changing or correcting your opinion as to the cause of the fire?
- 1794.** List all classes you have taken that have been devoted exclusively to the investigation of explosion?
- 1795.** List all classes you have taken on the subject of explosion investigation.
- 1796.** Is Patrick Kennedy's book on explosion investigation a learned treatise that you rely upon?
- 1797.** Name an explosion textbook that you accept as a standard?
- 1798.** List all explosion textbooks that you have studied.

- 1799.** Are you certified as a "Render Harmless" expert?
- 1800.** Have you ever rendered a bomb harmless?
- 1801.** Have you ever built a bomb?
- 1802.** Have you ever exploded a bomb?
- 1803.** What are the elements of an explosion?
- 1804.** Define explosion. (the sudden conversion of potential energy {chemical or mechanical} into kinetic energy with the production and release of gas(es) under pressure.)
- 1805.** Was there a loud noise during this fire?
- 1806.** Did anyone describe a noise consist with an explosion?
- 1807.** Did you ask any witness to the fire if they heard an explosion?
- 1808.** Are explosions usually accompanied by the production of a loud noise? (Yes)
- 1809.** Is the noise that accompanies an explosion an essential element in the definition of an explosion? (No)
- 1810.** What evidence of potential energy did you consider during your investigation of this scene? (Mechanical or chemical)
- 1811.** What is the primary criterion of an explosion? (violent escape of gases)

- 1812.** Did you eliminate the failure and bursting of a tank or vessel from hydrostatic pressure of a non-compressible fluid such as water during your investigation?
- 1813.** Do you commonly eliminate such failures?
- 1814.** Is there an acronym that describes such a failure?
- 1815.** Is such a failure an explosion? (No)
- 1816.** Are explosions exclusively gas dynamic? (Yes)
- 1817.** There are numerous factors that control the effects of explosions and the nature of the damage they produce, correct?
- 1818.** Did you carefully investigate this fire for the effects of an explosion?
- 1819.** Did you completely investigate this fire for the effects of an explosion?

- 1820.** Did you thoroughly investigate this fire for the effects of an explosion?
- 1821.** Did you investigate this fire scene for high-order damage explosions?
- 1822.** Did you investigate this fire scene for low-order damage explosions?
- 1823.** List all of the factors that control the effects of explosions and the nature of the damage they produce. (type, quantity, and configuration of the fuel; the size and shape of the containment vessel or structure; the type and strength of the materials of construction of the containment vessel or structure; and the type and amount of venting present)
- 1824.** Do you agree with the NFPA that there are two major types of explosions which investigators are routinely involved?
- 1825.** What are the two major types of explosions which investigators are routinely involved? (Mechanical and chemical)
- 1826.** Are you trained to identify evidence of a mechanical explosion?
- 1827.** What is the difference between a mechanical and chemical explosion? (A mechanical explosion has a reaction that does not involve changes in its basic chemical nature of the substances in the container)
- 1828.** What type of explosion is the most frequently encountered by the fire investigator? (BLEVE - Boiling Liquid Expanding Vapor Explosion)
- 1829.** Does a BLEVE meet the technical requirements of an explosion? (Yes)
- 1830.** Have you documented BLEVE's during your career?

- 1831.** If the contents of the vessel are non-combustible and there is no ignition of the vapors, can the vessel BLEVE? (No)
- 1832.** Are BLEVE's commonly found by fire investigator in residence fires? (Yes)
- 1833.** Can BLEVE's result from mechanical damage?
- 1834.** Can BLEVE's result from overfilling?
- 1835.** Can BLEVE's result from runaway reactions?
- 1836.** Can BLEVE's result from overheating vapor-space explosions?
- 1837.** Can BLEVE's result from mechanical failure?
- 1838.** What is the most common type of chemical explosion documented by fire investigators? (Combustion Explosion)
- 1839.** Did you eliminate a combustion explosion during your investigation of this fire?
- 1840.** What is a combustion explosion? (Burning of combustible hydrocarbon fuels)
- 1841.** Did you consider combustion reactions during your investigation?
- 1842.** Basic combustion reactions are classified by NFPA, correct?
- 1843.** What are the two basic types of combustion reactions? (Deflagrations and detonations)

1844. Did you consider a deflagration during your investigation?

- 1845.** Did you consider a detonation during your investigation?
- 1846.** Are you qualified to eliminate deflagrations and detonations?
- 1847.** What types of fuels did you consider when eliminating explosion? (flammable gases; vapors of ignitable liquids; dusts; low damage explosives, high damage explosives; smoke and incomplete combustion products {backdraft})
- 1848.** Did it rain the week before the fire?
- 1849.** Was there lightning in the area on the evening of the fire?
- 1850.** Did you consider lightning as a possible fire cause?
- 1851.** How did you eliminate lightning as a possible fire cause?
- 1852.** Did a high-energy electrical arc generate sufficient heat to cause an explosion?
- 1853.** Can a high-energy electrical arc generate sufficient heat to cause an explosion? (Yes)

- 1854.** What type of explosion if found with high-energy electrical arcs? (Mechanical)
- 1855.** Is the clap of thunder accompanying a lightning bolt an example of an electrical explosion effect? (Yes)
- 1856.** Are you trained in the investigation of electrical explosions?
- 1857.** Did you consider the differences in damages between low-order and high-order damages?
- 1858.** The differences in damage are more a function of the rate of pressure rise, correct?
- 1859.** What is the difference between the rate of pressure rise?
- 1860.** What is the difference between the strength of the confining or restricting structure or vessel?
- 1861.** Are the maximum pressures being reached important to the effects of damages from an explosion?
- 1862.** Were the walls bulged out or laid down next to the structure?
- 1863.** What type of explosion is consistent with walls bulged out or laid down next to the structure? (Low-order damages)
- 1864.** Is shattered, small, pulverized debris consistent with a low-order damage combustion explosion? (No - low-order damage)
- 1865.** Was the roof slightly lifted during this incident?

- 1866.** If the roof was slightly lifted and returned to its position, what type of explosion would you opine? (low-order damage combustion explosion)
- 1867.** The effects of explosions can be observed in four major groups, correct?
- 1868.** Did you consider these major groups during your investigation?
- 1869.** What are the groups? (blast pressure wave effect, shrapnel effect, thermal effect, and seismic effect)
- 1870.** What effect is primarily responsible for the damage and injuries associated with explosions? (blast pressure front effect)

- 1871.** Blast pressure fronts occur in two distinct phases, correct? (Yes)
- 1872.** What are the two distinct phases of blast pressure fronts? (positive and negative pressure phases)
- 1873.** Which phase of a blast pressure front is most powerful? (Positive pressure phase)
- 1874.** Which phase of a blast pressure front is responsible for the majority of the pressure damages? (Positive pressure phase)
- 1875.** A typical pressure history from an idealized detonation will contain a positive and negative pressure phases, correct? (Yes)
- 1876.** What is the NFPA term for the area under the pressure-time curve of an idealized detonation? ("impulse")
- 1877.** Is it necessary for a fire investigator to understand the shape of a blast front from an explosion?
- 1878.** Under ideal theoretical condition, what shape would the blast front assume?
- 1879.** Which direction does a blast front expand from the epicenter? (evenly in all directions)
- 1880.** In the real world, what effects the direction, shape, and force of the front of an explosion? (the confinement or obstruction of the blast pressure wave)
- 1881.** What part of the confining vessel or structure is likely to be damaged during the venting of an explosion? (outside of the vessel or structure)
- 1882.** The most damage can be expected to be in the path of the venting, correct?

- 1883.** What characteristics change the blast pressure front that is reflected off solid obstacles and redirected? (Characteristics of the obstacle struck resulting in a substantial increase or possible decrease in pressures)
- 1884.** After the propagating reactions have consumed their available fuel, what happened to the expanding blast pressure front? (decreases with the increase in distance from the epicenter of the explosion)
- 1885.** The type of damage caused by the blast pressure front of an explosion is dependent on what two factors? (the total amount of energy generated and rate of pressure rise)
- 1886.** Relatively show rates of pressure rise will produce the pushing or bulging type of damage effects seen in what types of explosion? (low-order damage)
- 1887.** Is the venting effect important in low-order damage explosions? (Yes)
- 1888.** Is the venting effect important to high-order damage explosion? (No)
- 1889.** Discuss the effects of the venting process during a high-order damage explosion. (Venting effects are not allowed sufficient time to develop)
- 1890.** Do you understand the importance of pressures developed by detonations and deflagrations?
- 1891.** What is the maximum theoretical pressures developed by detonations? (120 p.s.i.)
- 1892.** What is the maximum pressures developed by deflagrations in a well-built residence? (3 p.s.i.)
- 1893.** What characteristics effect the distance to which missiles can be propelled

outward from an explosion? (initial direction; aerodynamic conditions, ricochet impacts)

- 1894.** The thermal damage of detonations and deflagrations depend on the nature of the explosive fuel as well as the duration of peak temperature, correct?
- 1895.** It is important for fire investigators to understand to understand the thermal damage of detonations and deflagrations?
- 1896.** Discuss the duration and intensity of detonations? (extremely high temperatures of very limited duration)
- 1897.** Discuss the duration and intensity of deflagrations? (lower temperatures but for longer periods)
- 1898.** What factors can control the effects of explosions? (type and configuration of the fuel; nature, size, volume, and shape of any containment vessel or object affected; locaton and magnitude of ignition source; venting of the blast pressure wave; relative maximum pressure; and rate of pressure rise.)
- 1899.** Is reflection important in low-order damage explosions? (No, the pressure in an entire vessel equalizes at approximately the speed of sound in air)
- 1900.** Is reflection important in high-order damage explosions? (Yes, as a blast pressure front encounters objects in its path, the blast pressure front may amplify due to its reflection.)
- 1901.** Does reflection cause overpressure to increase? (Yes, sometimes it can amplify it as much as eight times at the surface of reflection, depending on the angle of incidence)
- 1902.** When a blast pressure front encounters a layer of air at significantly different temperature, it may cause it to refract {bend}, correct?
- 1903.** Why? (the speed of sound is proportional to the square root of temperature in air)

- 1904.** Where does a low level temperature inversion cause an initially hemispherical blast front to refract and focus? (on the ground around the center of the explosion)
- 1905.** Does a severe weather-related wind shear cause the blast front to refract and focus in a downhill or uphill direction? (downwind direction)
- 1906.** Is it important for a fire investigator to find the seat of an explosion? (Yes)
- 1907.** Define "seat" of an explosion. (the crater or area of greatest damage located at the point of initiation {epicenter})
- 1908.** In general, it is accepted that explosive velocities should exceed the speed of sound {detonations} to produce seated explosions, correct? (Yes)
- 1909.** If you found a seated explosion at a fire scene, would you opine that you have eliminated a deflagration?

- 1910.** Can a deflagration produce a seated explosion? (Yes by shrapnel from a failing vessel)
- 1911.** Can a boiler explosion create a seated explosion? (Yes)
- 1912.** What elements of a boiler explosion create a seated explosion? (high energy, rapid rate of pressure release, and confined area of origin)
- 1913.** If you discovered a non-seated explosion during a fire investigation, could you eliminate a fuel gas explosion? (Yes)
- 1914.** If you discovered a non-seated explosion during a fire investigation, could you eliminate a pooled flammable/ combustibles liquid explosion? (Yes)
- 1915.** If you discovered a non-seated explosion during a fire investigation, could you eliminate a dust explosion? (Yes)
- 1916.** If you discovered a non-seated explosion during a fire investigation, could you eliminate a backdraft explosion? (Yes)
- 1917.** Do you understand the fire triangle?
- 1918.** Pretty basic for a fire investigator, correct?
- 1919.** If you remove the heat or ignition energy from the fire triangle the fire is extinguished, correct?
- 1920.** If you never have the minimum heat or ignition energy in the first place then you do not have a fire in the first place, correct?
- 1921.** If you remove the required fuel/air ratio from the fire triangle the fire is extinguished, correct?

- 1922.** If you never have the required fuel/air ratio then you will not have a fire in the first place, correct?
- 1923.** Is that how you eliminate some heat sources?
- 1924.** Is it important for fire investigators to understand minimum Ignition energy of gases and vapors?
- 1925.** What type of fuels are the most easily ignitable fuels capable of causing an explosion? (gaseous fuel/air mixtures)
- 1926.** Did you have a reference or textbook at the fire scene during your investigation?
- 1927.** Did you reference any literature during your investigation of this fire?
- 1928.** Is the minimum ignition energy of common fuels important?
- 1929.** What is the minimum ignition energy required to ignited gases and vapors? (0.25 Mj)
- 1930.** What is the unit of measurement of ignition energy utilized by the NFPA? (Joules, kilowatts, or btu's.)
- 1931.** Explosion damage caused by low-order damage and high-order damage to structures is related to a number of factors, correct?
- 1932.** These factors are important for a fire investigator to understand?
- 1933.** Can you list these factors? (fuel/air ratio, vapor density of the fuel, turbulence effects, volume of the confining space, location and magnitude of the ignition

source, venting, and the characteristic strength of the structure)

- 1934.** Are you trained to carefully inspect a structure for damage as a method to eliminate an explosion?
- 1935.** Are you trained to thoroughly inspect a structure for damage as a method to eliminate an explosion?
- 1936.** Did you carefully inspect the structure for damage to eliminate an explosion?
- 1937.** Did you thoroughly inspect the structure for damage to eliminate an explosion?
- 1938.** Is the quality of your investigation of this fire consistent with the quality of investigation that you normally perform?
- 1939.** Can you identify any event that limited your investigation?
- 1940.** Did you have sufficient time?
- 1941.** Did you have sufficient resources?
- 1942.** Did you have sufficient human resources?
- 1943.** Did you have enough equipment?
- 1944.** Were you given the freedom to investigate?

- 1945.** Would you give your efforts in this investigation a good grade?
- 1946.** What grade would you give yourself for the quality of investigation, A+?
- 1947.** Is this the level of quality that your will provide in the future?
- 1948.** The nature of damage to the confining structure can be an indicator of the fuel/air mixture at the time of ignition, correct?
- 1949.** Do you know how to calculate flammable mixtures of gas and air for an explosion, given the fuel and size of the structure?
- 1950.** How would you make calculation for a room 10' X 10' X 8' if you fuel was gasoline with a lower explosive limit of 1.4%?
- 1951.** Isn't it true that entire volume calculations of flammable mixtures of gas and air are correct due to "pocketing" or collections of gases or vapors in a given area?

- 1952.** Where will the optimum concentration of vapors for the most violent explosion usually be found? (just slightly right of stoichiometric)
- 1953.** Are flame speed and burning velocity considerations that are important for professional fire investigators?
- 1954.** Do you understand these terms?
- 1955.** Define flame speed. (the local velocity of a freely propagating flame relative to a fixed point)
- 1956.** Define burning velocity. (the velocity at which a flame reaction front moves into the unburned mixture as it chemically transforms the fuel and oxidant into combustion products)
- 1957.** The sum of the burning velocity and the translational velocity of the flame front define what effect? (flame speed)
- 1958.** Did you consider fundamental burning velocity during your investigation?
- 1959.** Why?

- 1960.** What is fundamental burning velocity. (fundamental burning velocity is the burning velocity for laminar flame under stated conditions of composition, temperature, and pressure of the unburned gas. It is an inherent characteristic of a combustible and is on the existing parameters of temperature, pressure, confining volume and configuration, combustible concentration, and turbulence)
- 1961.** Did you consider the transitional velocity of the fuel in this fire?
- 1962.** Define transitional velocity. (...the sum of the velocity of the flame front caused by the volume expansion of the combustion products due to the increase in temperatures and any increase in the number of molecules. Any flow velocity of the flame front can be calculated from the fundamental burning velocity, which is report in NFPA 68, *Guide for Venting of Deflagrations.*)
- 1963.** Did you carefully examine this fire scene for post-explosion fire?
- 1964.** How did you perform that task?
- 1965.** Do explosions of mixtures near the LEL tend to produce post-explosion fires?
(No)
- 1966.** Why? (nearly all of the available fuel is consumed during the explosive propagation)
- 1967.** Do explosions of mixtures near the UEL tend to produce post-explosion fires?
(Yes)
- 1968.** Why? (fuel-rich mixtures. The delayed combustion of the remaining fuel produces the post-explosion fires.)
- 1969.** Does the vapor density of the fuel indicate the relative elevation of the structural explosion damage above floor level? (No)
- 1970.** Are you trained to inspect damage to dwelling from explosions?

- 1971.** Can the court rely upon your expertise in evaluation or elimination of explosion damage to a dwelling?
- 1972.** Does explosive pressure within a room equilibrate at the speed of sound, a wall will experience a similar pressure-time history across its entire height? (Yes)
- 1973.** Is the level of explosion damage within a conventional room a function of the construction strength of the wall headers and bottom plates? (Yes)
- 1974.** When investigating a suspected natural gas explosion would you expect to see the wall headers or bottom plates bulge? ("...the least resistive giving away first)

- 1975.** Does turbulence within a fuel/air mixture increase or decrease the flame speed? (increase)
- 1976.** Are you sure?
- 1977.** Does turbulence within a fuel/air mixture increase or decrease the rate of combustion? (increase)
- 1978.** Does turbulence within a fuel/air mixture increase or decrease the rate of pressure rise? (increase)
- 1979.** Can the shape and size of the confining vessel have a effect on the severity of the explosion? (Yes, by affecting the nature of turbulence)
- 1980.** Does the presence of obstacles in the path of the combustion wave increase or decrease turbulence? (increase)
- 1981.** Does the presence of obstacles in the path of the combustion wave increase or decrease the severity of the explosion? (increase)
- 1982.** Does the presence of obstacles in the path of the combustion wave increase or decrease the flame speed of the mixture? (increase)

- 1983.** Does the presence of forced ventilation increase or decrease the explosion effects? (increase)
- 1984.** Does the nature of the confining space change the effect of the explosion? (Yes)
- 1985.** What characteristics of containment change the effects of the explosion? (size, shape, construction, volume, material, and design)
- 1986.** The smaller the volume of the vessel for a given fuel/air mixture, the more or less violent the explosion? (more violent)
- 1987.** The higher the rate of pressure rise for a given fuel/air mixture, the more or less violent the explosion? (more violent)
- 1988.** During the explosion, can turbulence caused by obstructions within the containment vessel increase the damage effects? (Yes)
- 1989.** Are you knowledgeable about the location and magnitude of ignition sources from explosions?
- 1990.** What area of ignition within the confining structure will yield the highest rate of pressure rise? (Center)
- 1991.** Does the energy of the ignition source have a significant effect on the course of an explosion. (minimal)
- 1992.** Do unusually large ignition sources significantly increase or decrease the speed of pressure development? (Yes)
- 1993.** Can unusually large ignition sources cause a deflagration to transition into a detonation. (Yes)

- 1994.** Can the number, size, and location of doors and windows in a room determine whether the room experiences complete destruction or merely a slight movement of the walls and ceilings? (Yes)
- 1995.** Does proper venting reduce the effects of detonations? (No, venting effects are minimal as the high speeds of the blast pressure fronts are too fast for any venting to relieve the pressures.)
- 1996.** Did you consider the possible underground migration of fuel gases during your investigation?
- 1997.** Normally, fugitive gases will permeate the soil, migrate upward, and dissipate harmlessly into the air? (Yes)
- 1998.** What causes gases to migrate laterally and enter structures? (rain, snow, freezing, or new paving)
- 1999.** How do fuel gases migrate underground into buildings? (seeping into sewer lines, underground electrical or telephone conduits, drain tiles, or even directly through basement and foundation walls, none of which is as gas tight as water or gas lines)
- 2000.** Should odorant verification be part of any explosion investigation involving or potentially involving fuel gas? (Yes)
- 2001.** Why?
- 2002.** Have you ever verified odorant in a fuel gas?
- 2003.** How is that task commonly performed?
- 2004.** Are you trained to eliminate cascade explosions?
- 2005.** What is a cascade explosion? (multiple explosions)

2006. Does migration and pocketing effect sometimes cause cascade explosions?
(Yes)

2007. Did you inspect for "tidemarks"?

- 2008.** What are tidemarks? (when lighter or heavier-than-air gases are involved, there may be evidence of the passage of flame where the fuel air layer was)
- 2009.** Agree or disagree: Multiple explosions are a very common occurrence.
(agree)
- 2010.** Do explosions commonly occur so rapidly that witnesses commonly report hearing only one? (Yes)
- 2011.** Agree or disagree: The finer the dust, the less violent the explosion.
(disagree)
- 2012.** What is the minimum particle size required for an explosion hazard concentration of combustible dusts? (420 microns or less in diameter)
- 2013.** Does the concentration of the dust in air have an effect on its ignitibility and violence of the blast pressure wave. (Yes)
- 2014.** What is the reliable maximum limit of concentration for dust explosions?
(there is none)
- 2015.** Does moisture have an effect on the minimum energy required for minimum energy required for ignition? (Yes)

- 2016.** Does the moisture contents of the surrounding air have significant effect on the propagation reaction that has been ignited? (No)
- 2017.** What is the range of ignition temperatures you use when investigating dust incidents? (600 - 1,100 F)
- 2018.** Do layered dusts generally have lower or higher ignition temperatures than the same dusts suspended in air? (Lower)
- 2019.** What is the range of minimum ignition energy for the ignition of dusts? (10-40 millijoules)
- 2020.** Do dust explosions in industrial scenarios usually occur in a series or parallel? (series)
- 2021.** What pressures do you expect to find in backdraft? (2 psi)
- 2022.** Do subsonic blast pressure waves characterize low-damage explosives? (Yes)
- 2023.** Please give examples of low explosives. (smokeless gunpowder, flash powders, solid rocket fuels, and black powder)
- 2024.** Agree or disagree: High explosives are characterized by detonation propagation mechanisms. (Agree)
- 2025.** Please give examples of high explosives. (dynamites, water gel, TNT, ANFO, RDX, and PETN)
- 2026.** What is the detonation pressure of high order explosives? (one million p.s.i.)
- 2027.** Is intense burning or scorching away from the source common with a high explosion? (No)

- 2028.** What is the first duty of the investigator at the scene of an explosion? (secure the scene)
- 2029.** As a general rule, the outer perimeter of an explosion incident scene should be established at what distance from the farthest piece of debris? (1.5 times the distance of the farthest piece of debris found)
- 2030.** What types of search patterns are used by fire investigators? (spiral, circular, or grid shaped)
- 2031.** If during an investigation the investigator determines that the explosion was fueled by explosives, what actions are suggested by NFPA? (discontinue the scene investigation, secure the scene, and contact the appropriate law enforcement agency.)
- 2032.** Agree or disagree: Debris that has been propelled away from the point of origin should be examined to determine whether it has been burned. (Agree)
- 2033.** Agree or disagree: Burned debris may be an indicator that a fire preceded the explosion. (Agree)
- 2034.** What is the most common sign of an overpressure condition? (window glass thrown some distance from the windows of the structure)
- 2035.** What information is gained from the finding of the residue of smoke or soot on fragments of window glass? (the explosion followed the fire)
- 2036.** What information is gained from the finding of clean glass thrown long distances from the structure? (explosion preceding the fire)
- 2037.** What information is gained from an examination of the flow of melted and resolidified debris? (the position or attitude of the debris at the time of heat exposure)

- 2038.** What should the investigator do after identifying the force vectors? (trace backwards from the least to the most damaged areas)
- 2039.** Do you know how to perform an explosion dynamics analysis?

- 2040.** What is an explosion dynamics analysis? (After identifying the force vectors, the investigator should trace backward from the least to the most damaged areas following the general path of the explosion force vectors)
- 2041.** What type of pattern is used to perform an explosion dynamics analysis? (roughly spherical pattern)
- 2042.** Agree or disagree: The explosion dynamics analysis is often complicated by evidence of a series of explosions, each with its own epicenter. (Agree)
- 2043.** A series of explosions calls for a detailed comparison of what type of vectors? (force)
- 2044.** Under what condition would you expect to find secondary or subsequent explosions that are more powerful than the first? (dust explosions)
- 2045.** Once a fuel is identified, what is the next task for the investigator? (identify the source)
- 2046.** What is an "iso-damage contour map"? (relative damage to the areas surrounding the explosion site)
- 2047.** What is an "isothermal diagram"? (heat damage chart)

ELECTRICITY AND FIRE – Chapter 14

- 2048.** Agree or Disagree: Prior to beginning an analysis of a specific electrical item, it is assumed that the person responsible for determining the cause will have already defined the area or point of origin. (Agree)
- 2049.** Agree or disagree: Electrical equipment should be considered as an ignition source equally with all other possible sources and not as either a first or last

choice. (Agree)

- 2050.** Agree or disagree: The presence of electrical wiring or equipment at or near the origin of a fire does not necessarily mean that the fire was caused by electrical energy. (Agree)
- 2051.** Agree or disagree: Often the fire may destroy insulation or cause changes in the appearance of conductors or equipment that can lead to false assumptions. (Agree)
- 2052.** Agree or disagree: Electrical conductors and equipment that are appropriately used and protected by properly sized and operating circuit breakers do not normally present a fire hazard. (Agree)
- 2053.** Agree or disagree: A condition in the electrical wiring that does not conform to the National Electric Code might or might not be related to the cause of the fire. (Agree)
- 2054.** What does Ohm's Law mean to a fire investigator?
- 2055.** What is Ohm's Law? (the in a circuit is equal to the current multiplied by the resistance or $E=IR$)
- 2056.** What amounts of Btu's are equal to one watt-hour? (3,413 Btu's)
- 2057.** What is the importance of watt-hours to a fire investigator? (It allows calculation of heat generated from a known amount of watts)
- 2058.** Power is expressed in what unit of measurements?
- 2059.** Is an overload absolute proof of an electrical fire? (No. If an overload occurred, this cord could be considered as a possible ignition source, particularly if the heat was confined or trapped, such as under a rug or between a mattress and box spring, preventing dissipation.)

- 2060.** How many phase-service are found at most residences? (Single-Phase Service)
- 2061.** Where would you look to inspect a lateral service? (Underground)
- 2062.** What is the proper length of a grounding electrode? (8 feet)
- 2063.** What are grounding electrodes made of? (Galvanized steel rod, pipe, or copper rod)
- 2064.** May flexible metallic conduit be used for grounding? (Yes, if it's length does not exceed 6 feet)
- 2065.** Does your methodology include the inspection of the over-current protection of the structure?
- 2066.** Do you include a careful inspection of the grounding system during your scene investigation?
- 2067.** Do you meter the grounding rod? (No value)
- 2068.** Does proper grounding effect the operation of electrical breakers? (Yes)
- 2069.** Occupants reporting incandescent lights that were too bright or too dim or appliances that overheated or malfunction in some way evidence what type of electrical malfunction? (floating neutral)
- 2070.** Do floating neutrals cause higher voltage? (Yes)
- 2071.** Do floating neutrals cause lower voltage? (Yes)

- 2072.** What damage is caused by higher voltage? (Higher voltage can overheat or burn out some equipment)
- 2073.** What damage is caused by lower voltage? (Lower voltage can damage some electronic equipment)
- 2074.** How many current ratings does a protective device offer? (Two - regular current rating and the interrupting current rating)
- 2075.** What is the regular rating of the device? (The regular rating is the level of current above which the device will open such as 15, 20, 40, or 50 amps)
- 2076.** What is the interrupting rating of an over-current protection device? (The interrupting rating is the level of current that the device can safely interrupt)
- 2077.** What is the common interrupting rating value for a circuit breaker? (10,000 amps)

- 2078.** Combustion reactions can only be sustained if the flame temperature is high enough, typically greater than what temperature? (1,300 Fahrenheit)
- 2079.** What is the speed of the reaction front of a smoldering fire? (1-5 mm/minute)
- 2080.** Glowing combustion is indicative of what minimum temperature? (1,000 C)
- 2081.** Agree or disagree: The larger the fuel array, the more the system is prone to spontaneous combustion. (agree)
- 2082.** What is the term used to describe the lowest temperature to cause spontaneous ignition phenomenon. (autoignition temperature)
- 2083.** What is the speed of flame propagation under laminar conditions? (0.1 - 0.5 meters per second)
- 2084.** Are you familiar with Rankine and Kelvin temperatures?
- 2085.** What is the boiling point of water in Kelvin? (373K)
- 2086.** What is the boiling point of water in Rankine? (672R)
- 2087.** What is the freezing point of water in Kelvin? (273K)
- 2088.** What is the freezing point of water in Rankine? (492R)
- 2089.** What is the importance of the Stefan-Boltzmann constant in the transfer of heat? (Radiation - perfect radiator or blackbody)

- 2090.** What is the importance of the absorption coefficient? (That property that pertains to the amount of radiation absorbed per unit length)
- 2091.** What is the importance on the configuration factor when considering the effect of radiation? (The fraction of energy reduced; the fraction of radiation received by a target compared to the total emitted by the source)
- 2092.** Agree or disagree: The computation of radiant heat flux to a target is very important to assess potential damage and the possibility of a remote ignition. (Agree)
- 2093.** What is the radiant heat flux from the sun at the Earth's surface? (1 kW/m²)

- 2094.** What is the minimum threshold value of heat flux required to cause pain to bare skin? (1.0 kW/m²)
- 2095.** What is the minimum threshold value of heat flux required to cause a burn to bare skin? (4 kW/m²)
- 2096.** What is the minimum threshold value of heat flux required to cause ignition of combustibles? (10 - 20 kW/m²)
- 2097.** What is the smoke layer temperature associated with flashover? (500 - 600C; 1300F)
- 2098.** What is the most common ignition process? (piloted ignition)
- 2099.** What is critical heat flux? (a threshold level below which ignition or flame spread is not possible)
- 2100.** What is specific heat? (property that measures the ability of matter to store energy)
- 2101.** What induces natural air flow in a fire? (buoyancy)
- 2102.** What is the chief mechanism that makes liquid surface flame spread different from solids. (Surface tension variation)
- 2103.** What is the spread rate of fire upward? (1 to 200 cm/s)
- 2104.** What is the spread rate of fire downward? (0.001 to 0.01 cm/s)
- 2105.** What is the heat of gasification? (energy required to produce fuel vapor from

a solid or liquid)

- 2106.** What is reradiation? (the radiation reemitted from a heated surface)
- 2107.** What is an oxygen bomb? (a device for measuring the maximum energy released in combustion for a given mass of fuel)
- 2108.** What is the only practical way to determine the burning rate or energy release rate of an item? (direct measurement)
- 2109.** What is the simplest way to estimate energy release? (measure mass loss rate by burning an object on a scale)
- 2110.** What are the NFPA classifications of fire growth? (slow, medium, fast, and ultrafast)
- 2111.** What is the NFPA mean burn time of a slow fire? (600 seconds)
- 2112.** What is the NFPA mean burn time of a medium fire? (300 seconds)
- 2113.** What is the NFPA mean burn time of a fast fire? (150 seconds)
- 2114.** What is the NFPA mean burn time of a ultrafast fire? (75 seconds)
- 2115.** What is a pool fire? (a fire involving horizontal fuel surfaces, usually symmetrical)
- 2116.** What is a line fire? (elongated fire on a horizontal fuel surface)